SMITHSONIAN INSTITUTION.

UNITED STATES NATIONAL MUSEUM.

PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM.

Volume XI.

1888.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1889.

ADVERTISEMENT.

The extension of the scope of the National Museum during the past few years, and the activity of the collectors employed in its interest, have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man.

The importance to science of prompt publication of descriptions of this material led to the establishment, in 1878, of the present series of publications, entitled "Proceedings of the United States National Museum," the distinguishing peculiarity of which is that the articles are published in signatures as soon as matter sufficient to fill sixteen pages has been obtained and printed. The date of publication being plainly expressed on each signature, the ready settlement of questions of priority is assured. The present volume constitutes the eleventh of the series.

The articles in this series consist: First, of papers prepared by the scientific corps of the National Museum; secondly, of papers by others, founded upon the collections in the National Museum; and, finally, of facts and memoranda from the correspondence of the Smithsonian Institution.

The Bulletins of the National Museum, the publication of which was commenced in 1875, consist of elaborate papers based upon the collections of the Museum, reports of expeditions, etc., while the Proceedings facilitate the prompt publication of freshly-acquired facts relating to biology, anthropology and geology, descriptions of restricted groups of animals and plants, the discussion of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

Other papers, of more general popular interest, are printed in the Appendix to the Annual Report.

Papers intended for publication in the Proceedings and Bulletins of the National Museum are referred to the Committee on Publications, composed as follows: T. H. Bean, A. Howard Clark (editor), Otis T. Mason, John Murdoch, Leonhard Stejneger, Frederick W. True, and Lester F. Ward.

S. P. Langley,
Secretary of the Smithsonian Institution.

TABLE OF CONTENTS.

LIST OF ILLUSTRATIONS.

TEXT FIGURES.

PLATES.

DATES OF PUBLICATION OF SIGNATURES.

The signatures of this volume were received from the Public Printer and published by the Smithsonian Institution as follows: Signatures 1-8, November 8, 1888; 9-11, January 5, 1889; 12-15, March 12; 16-19, March 26; 20-27, July 5; 28-33, September 3; 34-35, September 20; 36-41, September 25; 42, September 27.

LIST OF ERRATA.

Page 30, line 17, for *lithæformis* read *litsæformis*.
Page 4 , bottom line, for "Lesquereux" read "Newberry."
Page 123, line 6, for "crystals at" read "crystals of;" for "none pleochroic" read "nonpleochroic."
Page 123, line 30, for "inclosure" read "inclosures."
Page 127, line 36, for "chloromelite" read "chloromelanite."
Page 129, line 32, for "two" read "too."
Page 130, line 11, for "Liberia" read "Siberia."
Page 324, line 23, for "*Gobiescoidæ*" read "*Gobiesocidæ*."
Page 325, line 20, for "other" read "their."
Page 326, line 21, for "species *Neophrynichthys*" read "species of *Neophrynichthys*."
Page 327, line 5, for "Hector" read "Hutton."
Plate XXI, authority for *Sassafras cretaceum* should be Newberry, not Lx.
Plate XLIII, for *Notorus* read *Noturus*.

PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM,

1888.

NEW SPECIES OF FOSSIL WOOD (ARAUCARIOXYLON ARIZONICUM) FROM ARIZONA AND NEW MEXICO.

BY F. H. KNOWLTON, ASS'T CURATOR, FOSSIL PLANTS.

(With Plate I.)

The material which furnished the basis of the following observations was selected from the large fossil trunks that have been on exhibition for several years past at the main entrance of the U. S. National Museum. These trees came originally from Arizona and New Mexico, in the vicinity of Fort Wingate. Their presence here is due to a suggestion made by General W. T. Sherman, while on a tour across the continent in the fall of 1878, to Lieut.-Col. P. T. Swaine, Fifteenth U. S. Infantry, then in command of the post of Fort Wingate, N. Mex. Acting upon this suggestion, an expedition was organized by Colonel Swaine early in the spring of 1879 for the purpose of procuring suitable specimens for the Smithsonian Institution. The outfit, in command of Second Lieut. J. T. C. Hegewald, consisted of a sergeant and twelve soldiers of the Fifteenth U. S. Infantry, with heavy wagons, suitable for hauling stone.

Following is an account of the expedition, as given by Lieutenant Hegewald:*

We made the usual drives, stopping at a forage agency each night, until we arrived at Navajo Springs, Ariz.

At Navajoe Springs we left the road, cutting diagonally across the country about 20 miles, arriving at Bear Spring, near the head of Lithodendron in the evening. We had to cross several arroyos, but, being in the dry season, we had nothing to fear from water or marshy soil. The country traversed was desolate and barren, sage-brush and piñon trees abounding, good grazing and water being very scarce. Here and

*Proc. U. S. Nat. Mus., v, 1882, pp. 1, 2.

Nov. 8, 1888

there mountain peaks stood out in bold relief like great sign-posts to guide the t v-eler on his way. The water, when found, was in small quantities and alkaline.

Camping at Bear Spring, I turned the mules out to graze and left the men to e-pare an early dinner while I rode down the valley to examine the thousands of spi-mens that lay scattered on each side of the valley along the slopes, which were perh ps 50 feet high, the valley of the Lithodendron, at its widest part, being scarcely ha a mile. Along the slopes no vegetation whatever was to be seen, wood being v y scarce. The soil was composed of clay and sand mostly, and these petrifactic s, broken into millions of pieces, lay scattered all adown these slopes. Some of e large fossil trees were well preserved, though the action of heat and cold had brol n most of them in sections from 2 to 10 feet long, and some of these must have been mense trees. Measuring the exposed parts of several, they varied from 150 to 200 f t in length, and from 2 to 4½ feet in diameter, the centers often containing most beauti quartz crystals.

I encountered considerable difficulty in trying to procure two specimens answeri to the General's description, and which I thought would please. After finding t larger of the two fossils sent, I could find no mate, the remainder being of a differe species, and the exposed part broken in segments too short to answer. Finally I co cluded to unearth part of the same specimen, which entered the ground at an ang of about twenty degrees.

Bringing back men and teams, I dug along some 30 feet, finding the second da specimen, which made a good match, and which saw the light, perhaps, for the fir time for ages, though both were parts of the same tree. This was on the right bar of Lithodendron, 1¼ miles from Bear Spring. I got both fossils loaded on the wagon and camped at the spring that night.

In Colonel Swaine's letter, which probably accompanied the spec mens, the following additional information concerning these is given:

Only one of the two specimens obtained from the Lithodendron by Lieutenan Hegewald was forwarded to Washington. This is the large dark-colored one. I the place of the second one brought in from the locality of the Lithodendron a bette specimen was found on the mesa to the north of and adjacent to Fort Wingate, abou 2 miles from the flag-staff. This is the smaller and lighter-colored one.

From this it would appear that only two specimens were sent to Wash-ington, but as there are two which, being darker colored, answer wel the description of those obtained at Lithodendron, and another lighter one, which is probably the one from the vicinity of Fort Wingate, we may suppose that it was afterwards decided to send all three specimens. Certain it is that there are three here now.

The light colored one, which presumably came from Fort Wingate, N. Mex., is about 11 feet long, and has a diameter at the larger end of 2½ feet, and at the smaller end of about 2 feet. The segment under consideration came evidently from near the base of the trunk, as the large end is broken off just at the point where it begins to enlarge and spread out into the roots. The whole trunk has been subjected to con-siderable pressure, as is shown by the fact that it is slightly elliptical in cross section. This is further confirmed by the microscopical examina-tion which shows the cells to be slightly compressed. It is perfectly silicified and exteriorly is light gray in color. The interior is very dark, nearly black, due to the presence of iron.

* Proc. U. S. Nat. Mus., v, 1882, p. 3.

The two remaining specimens, which probably came from Lithoden-on, in Arizona, are black throughout. The larger is about 8 feet in ngth and decidedly elliptical in cross-section, the larger end measur-g $20\frac{1}{2}$ inches in long and $13\frac{1}{2}$ inches in short diameter, the smaller d 17 inches in long and 12 inches in short diameter. The smaller ecimen is 6 feet 4 inches long, and is also considerably compressed, e long and short diameter of the large end being respectively 24 by inches and of the small end 17 by 12 inches.

In regard to the geological horizon to which these fossils belong, aj. J. W. Powell, who has recently visited this section of the country, clines to regard them as of Jurassic age. Other evidence points to eir Cretaceous age, but until further and more definite knowledge obtained these views must be regarded as uncertain.

A microscopical examination shows the internal structure of all to ave been tolerably well preserved, the cells having suffered but little om the pressure to which the trunks had been subjected. They all elong to the genus *Araucarioxylon*, and probably are of the same ecies. The two from Lithodendron are absolutely identical in struct-re, but the one from Fort Wingate, as it lacks some of the essential aracters, is referred provisionally to the same species. More abun-ant material may clear up all doubtful points.

The only material that has been examined microscopically from this art of the country, so far as I am able to learn, was that collected by r. Baldwin Möllhausen, a German traveler, in the valley of Rio Seco, ew Mexico, about the year 1854. These specimens were submitted to r. H. R. Göppert, of Berlin, who reported upon them in Möllhausen's Reise vom Mississippi nach den Küsten der Südsee," p. 492. Among hese specimens Göppert detected a new species, which, in honor of the iscoverer, he named *Araucarites Möllhausianus*, but did not indicate ny of the characters upon which it was founded, nor can I find that was ever subsequently described. The specimens belonging to the ational Museum represent an undescribed species of *Araucarioxylon* *Araucarites* Presl.), which may possibly be the *Araucarites Möllhausi-nus* of Göppert, but it is manifestly impossible to decide this, except y an examination of the original specimen which Göppert says (*l. c.*) s deposited in the mineralogical cabinet of the University of Berlin. have consequently decided to describe these species as new under the ollowing name:

Araucarioxylon arizonicum, n. sp.

Araucarites möllhausianus? Göpp., in Möllhausen's "Reise," p. 492.

Diagnosis.—Annual ring not apparent to the naked eye, but under he microscope observed to be present, the yearly growths being sepa-ated by a layer of 2–5 tangentially compressed cells; tracheïds with oderately thick walls, which are provided on the radial sides with a single row of large contiguous pores or rarely with two rows of alter-ating pores, and on the tangential sides with numerous, separated,

perfectly round, small pores; medullary rays numerous, compose single series of 1–22 short, superimposed cells; resin ducts (Pl. I, figs. 1–5.)

Transverse section.—The cells in this section are observed to l indicated above, moderately thick walled, and to be separated by interecellular spaces. The largest cells observed have a diamet .055ᵐᵐ and the smallest of about .020ᵐᵐ, the average being about .0

Radial section.—As seen in this section the tracheids are observ be long, and to be provided with numerous pores. These por bordered pits are usually arranged in a single linear series, and ber from 40 to 80 or more on each cell. (Fig. 4.) Usually they t each other slightly, but sometimes, as indicated in Plate I, figu they become a trifle compressed by actual contact. When these pore arranged in two series, as illustrated in Plate I, figure 5, they alte and are slightly, if at all, angled by mutual pressure. The pore rather large, the average diameter for the outer circle being a .02ᵐᵐ, that for the inner .0040ᵐᵐ.

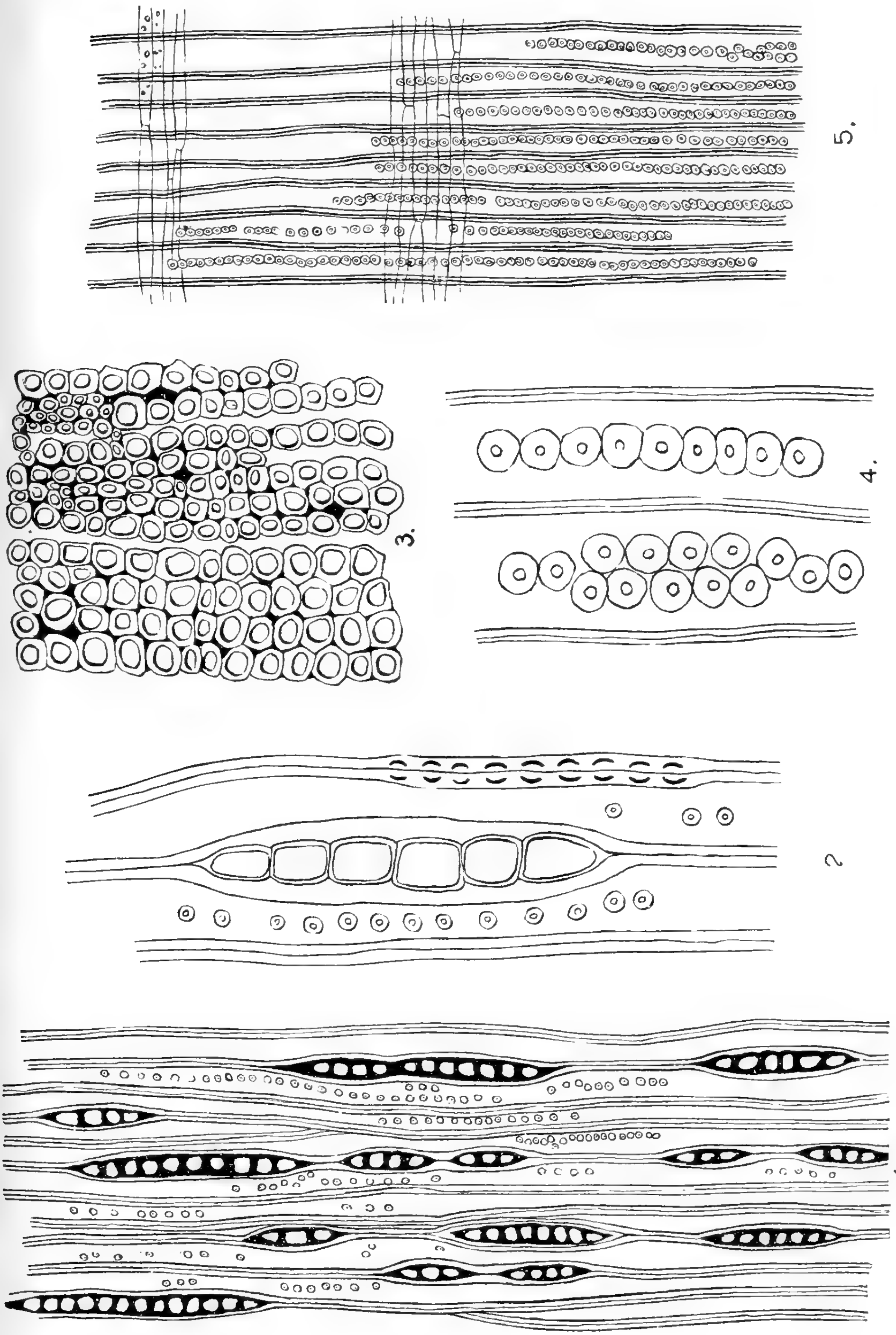
The medullary rays are composed of short, thin-walled cells, wl in some instances, seem to have been provided with small oval p They are difficult of demonstration, and it is possible that the gran contents of the cells may give the appearance of exterior marking.

Tangential section.—This section demonstrates the presence of p or bordered pits on the tangential walls, a circumstance of infreq occurrence in the genus *Araucarioxylon.* They are much smaller t the pores on the radial walls, and are in a single or rarely in two se The pores are always separated from each other, sometimes widely The diameter of the outer circle is about .0075ᵐᵐ, and that of the ir is about .0027ᵐᵐ.

The medullary rays are numerous and range in height from 1 t cells. It is possible that in some rare cases they may be in two ser but this is certainly not commonly the case.

No resin ducts have been detected in any of the sections, their sence being a well-known character of the genus.

An examination of the literature of the subject shows relationship tween this and several described species. Thus *Araucarioxylon K deanum* (Göpp.), Kraus (see Göppert, Monog. d. foss. Conif. p. 235, XLV, figs. 6, 7, and Foss. Fl. d. perm. Form. p. 256, Pl. LVII, figs. 1 a well-known species from the Permian of Silesia, very much resemb it, yet there are minor points of difference in the histological eleme as well as the great difference in the geological and geographical p tion. So also with *A. vogesiacum* Kraus, *A. Thuringicum* Kraus, *A. ginianum* Knowlton, MS., and others.



Araucarioxylon Arizonicum. New species of fossil wood. (Page 3.)

SCRIPTION OF TWO NEW SPECIES OF FOSSIL CONIFEROUS WOOD FROM IOWA AND MONTANA.

BY F. H. KNOWLTON, ASS'T CURATOR, FOSSIL PLANTS.

(With Plates II, III.)

he material upon which the following observations are based was t by the Rev. E. M. Glasgow, of Estherville, Iowa, to Mr. W. J. McGee, he U. S. Geological Survey, and by him sent to the U. S. National seum for examination. The specimens are eight in number and are y small fragments, the larger being but 6^{cm} in length and 4^{cm} in neter.

efore passing to the description of the species it may be well to speak efly of the arguments in favor of conferring generic and specific nes upon woods of this character. It has been objected to on the und that the characters available for the satisfactory identification enera or species are so vague and imperfect that it is not worth while onfer names upon such material. As an example of this view may cited Sir William Dawson's recent paper, "Note on Fossil Woods other Plant Remains, from the Cretaceous and Laramie Formations he Western Territories of Canada,"* in which no specific names or criptions are given, and the genera are compared to a few typical liv- genera.

Iow, all students who have given their attention to the investigation he internal structure of fossil plants are willing to admit that their alled genera and species are not as definitely circumscribed nor as rly characterized as they could be if living, but it does not seem t they are on this account any the less valuable as furnishing marks stratigraphic identification or data for the elucidation of problems of elopment. The objects of this study are twofold: First, to supply o supplement a history of the evolution of the vegetable kingdom, l, second, to give assistance to the stratigraphic geolcgist. And in ier case, if the facts obtained are to be made use of, the specimens died must be described and named, in order that subsequent workers y be able to recognize and speak intelligibly of the results attained. he further objection to naming or describing woods, that they are bably already named from other parts, such as leaves or fruits of same plant, is even less defensible than the first, for it is manifestly possible, except in rare instances, to correlate all parts of a fossil nt. It would, of course, be desirable to know the complete life-history any species, but until all the organs are found in actual contact it is safe to assume identity, and it is also seemingly undesirable to ect one series of data to the exclusion of the other.

* Trans. Roy. Soc. Canada, Sec. iv, 1887, pp. 31–37.

The specimens in this collection have all proved to be coniferous a to belong to the genus *Cupressinoxylon*.* The first species I ha named, in honor of the collector:

Cupressinoxylon Glasgowi, n. sp. Plate II, figs. 1–5.

Diagnosis.—Annual rings very sharply marked, 3 to $4\frac{1}{4}^{mm}$ broa tracheïds in the summer wood provided on the radial walls with one two series of very large bordered pits; medullary rays numerous, o to 30 superimposed cells in a single series, resin ducts moderat numerous, of a chain of short cells.

Locality, Emmet County, Iowa. Horizon probably Cretaceous.

MICROSCOPIC ANALYSIS.

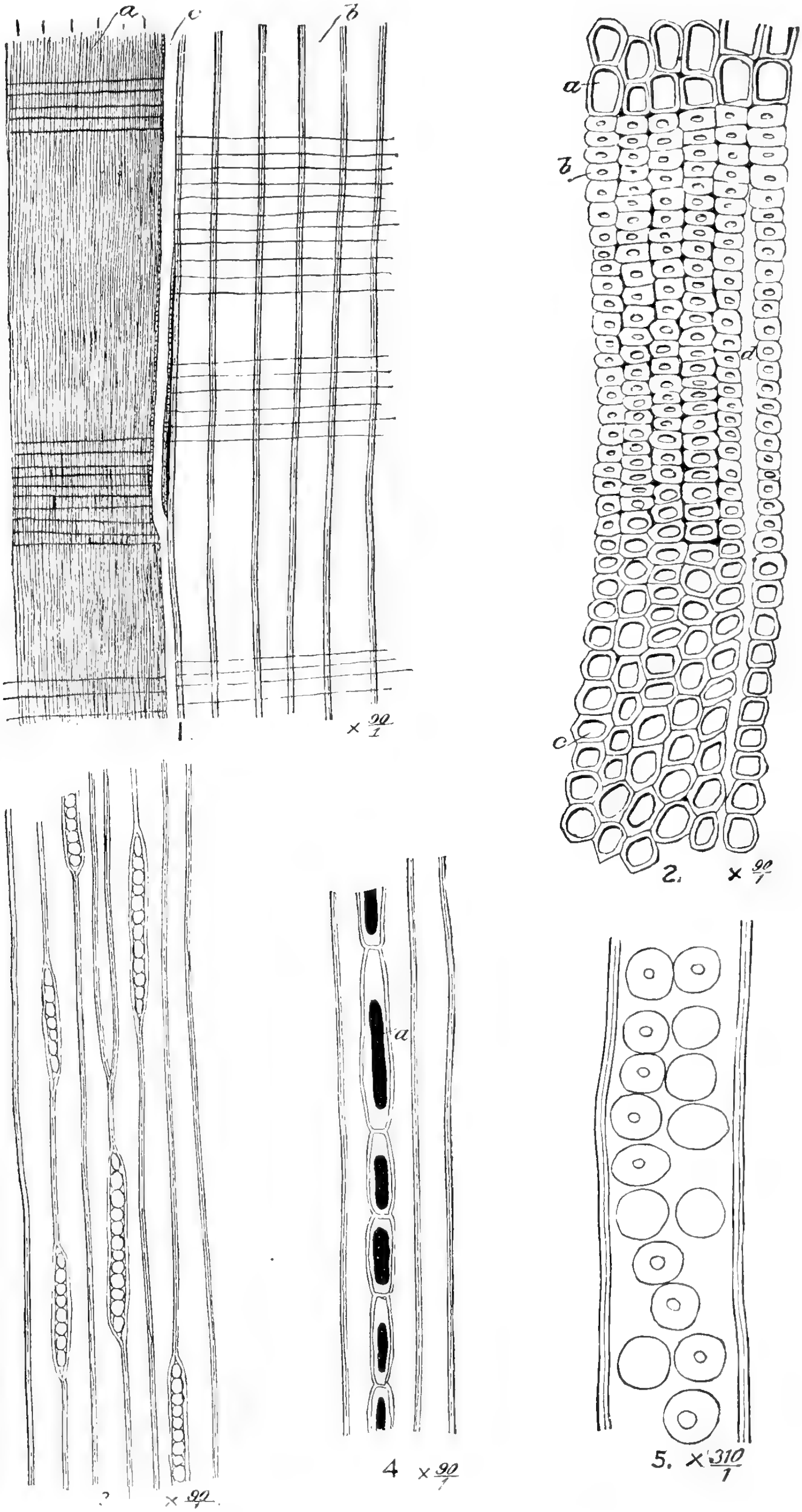
Transverse section.—The annual rings as observed in this section a very apparent to the naked eye, the actual ring or line of separati being a brown band nearly a millimeter in width, while the whole wid of a ring, as stated above, is often more than 4^{mm}. Under the mic scope the cells are shown to be arranged in strict radial rows, and t band above mentioned is found to consist of a layer of from 18 to cells more or less completely lignified. In the outer layers of this l nified band of fall-wood the lumen of the cells is reduced to a minimu The lumen is in the form of an ellipse of which the long diameter is le than $.01^{mm}$ and the short diameter about $.005^{mm}$. In the immediate following layer of spring-wood the cells are very large and thin-walle measuring $.08^{mm}$ in long, and $.05^{mm}$ in short, diameter. In the summ wood the cells become smaller and more nearly hexagonal in outli and pass abruptly into the band of fall-wood.

Radial section.—In this section, as in the transverse, the demark tion between fall and spring wood is very clearly marked (Pl. II, fig 1, 4, 5.) The walls of the cells in the spring and summer wood are the on ones provided with bordered pits, and in these they seem not to hav been very abundant, or at least are not preserved in a manner capab of demonstration. These pits are usually arranged in two parall rows, although in some cases there is but one row, when it occupies t center of the cell. The pits are large, and when in two rows take u nearly the entire width of the cell. The diameter of the outer circle in extreme cases fully $.0250^{mm}$, the average being about $.0200^{mm}$; t diameter of the inner circle is only .0025 to $.0040^{mm}$.

The medullary rays are observed to be numerous, with the individu cells very long. The individual cells are not, however, very high, an they are thin-walled. They have not been provided with border pits, or at least none are preserved.

The resin-ducts have been moderately numerous. They are compose of a chain of short thin walled cells from $.15^{mm}$ to $.25^{mm}$ in length, an

* Many authors write *Cupressoxylon*, but as I regard *Cupressineæ* as the root fro which the word is formed I prefer to write *Cupressinoxylon*.



Cupressinoxylon Glasgowi. New species of fossil wood. (Pages 6, 8.)

(Explanation of plate on page 8.)

are partially filled with a dark mass representing the resin. (Pl. II, fig. 4.)

Tangential section.—In this section the medullary rays are observed to be composed of a single series of cells which ranges from 3 to 30 in number. It is rare, however, to find them with as few as 3 or as many as 30 cells, the average number being from 8 to 15.

Bordered pits have not been observed in this section.

This beautiful species is one of the most clearly marked of any that has been described. It is apparently related with several that have been described from Russia, but it differs in important particulars from all. Thus it resembles the *Cupressinoxylon sequoianum* Mercklin,* which has the wings only one-half to 2^{mm} broad; sometimes three or four series of bordered pits, and 1–40 or more superimposed cells in the medullary rays. From *Cupressinoxylon sylvestre* Merckl.† it differs, as the latter has one, rarely two, rows of pits on the radial walls of the tracheïds and the medullary rays, 2–15 cells high. *Cupressinoxylon sanguineum* Merckl.‡ has the pits in one, or rarely in two, irregular series, and the rays are composed of only 2–18 superimposed cells.

The specimens are completely chalcedonized and stained a yellowish brown color. As to their age Mr. W. J. McGee informs me§ that "there is every probability that the Emmet County, Iowa, wood is from the Cretaceous, though it has been found in the drift, the Cretaceous strata from which it was originally derived having formerly extended over contiguous parts of Minnesota and been largely removed by glacial erosion during the Quaternary." Specimens from Martin County, Minn., are indistinguishable from the Emmet County specimens.

Cupressinoxylon elongatum, n. sp. Plate III, figs. 1–4.

Diagnosis.—Annual rings apparent to the naked eye but faint, one-half to 6^{mm} broad; tracheïds thick-walled, provided with two, rarely one, rows of bordered pits on radial walls; medullary rays numerous, composed of short thin-walled cells, arranged in a single series of from 1 to 44 superimposed cells; resin-ducts moderately abundant, composed of a chain of short cells.

Locality.—Tiger Buttes, Dawson County, Mont. Age, probably Laramie group.

MICROSCOPIC ANALYSIS.

Transverse section.—The layer of fall-wood separating the contiguous rings is narrow, consisting of only six to ten rows of flattened and thick-walled cells. The cells of the spring and summer wood are much larger and nearly rectangular in outline. Their radial diameter is as great as $.105^{mm}$ in some cases, while the tangential diameter is only .035 to $.04^{mm}$.

* Palæodendrologikon Rossicum, p. 65, Pl. XVII.

† *Op. cit.*, p. 58, Pl. XIII, figs. 1–6.

‡ *Op. cit.*, p. 57, Pl. XII.

§ *In litt.*, January 4, 1888.

The average size is of course much less, being about .07^{mm} in long, and .03 to .05^{mm} in short, diameter. The medullary rays are observed to be numerous. The largest cells are in contact with the medullary rays.

Radial section.—The wood cells or tracheïds appear broad and thick-walled in this section, and to be provided with two rows of very large pits which nearly touch in the center, and are in contact with the walls on the outside. The diameter of the outer circle is .020^{mm}, that of the inner .0040 to .0060^{mm}. They are rarely in a single row when they occupy the center of the cell.

The resin-ducts consist of a chain of short cells the contents of which are not preserved.

Medullary rays abundant; individual cells long, covering the width of six or eight tracheïds; thin-walled. They seem not to have been provided with pits or markings.

Tangential section.—Medullary rays in a single series, and rarely, of 1–44 superimposed cells. It is not common to find rays with less than 5 cells or more than 30, the average being about 10 to 25. No pits on the walls of the tracheïds.

The single specimen upon which this species is founded was collected by Mr. Glasgow from "a log 30 feet long in clayey soil."* It is the ordinary silicified wood so common from this part of the country. Its age is, without doubt, Laramie, as it is not far from Glendive, from which come typical Laramie plants.

As in the case of the species first described, this species has affinities with forms already described from Russia and elsewhere, but the differences are such as to entitle it to specific distinction.

EXPLANATION OF PLATES.

Plate II.

Figs. 1–5. *Cupressinoxylon Glasgowi*, n. sp. From Emmet County, Iowa.

Fig. 1. Radial section, × 90. *a*, Dense fall-wood; *b*, large-celled spring-wood; *d* shows ready separation of spring and fall wood.

Fig. 2. Transverse section, × 90. *a*, Spring-wood; *b*, fall-wood; *c*, summer-wood; *d*, single medullary ray.

Fig. 3. Tangential section, × 90.

Fig. 4. Radial section through resin-duct. *a*, Resin in duct.

Fig. 5. Radial section, × 310. Single tracheïd, showing arrangement of pits.

Plate III.

Figs. 1–4. *Cupressinoxylon elongatum*, n. sp. From Tiger Buttes, Dawson County, Mont.

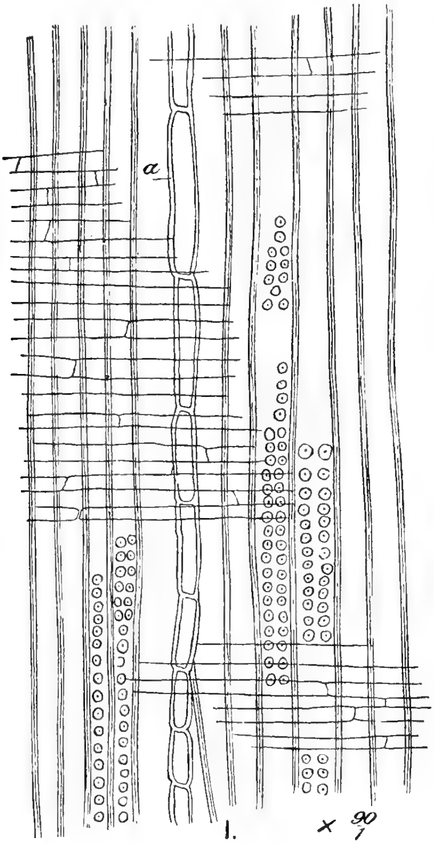
Fig. 1. Radial section, × 90. *a*, Resin-duct.

Fig. 2. Tangential section, × 90.

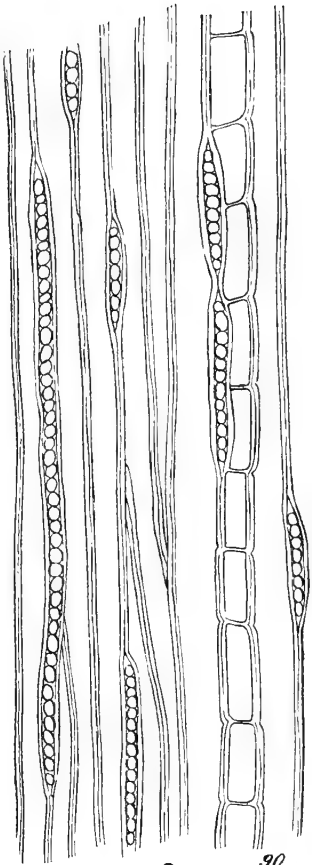
Fig. 3. Radial section, × 310. Showing the arrangement of pits.

Fig. 4. Transverse section, × 90. *a*, Cells of spring-wood; *b*, cells of summer-wood; *c*, cells of fall-wood; *e*, medullary ray.

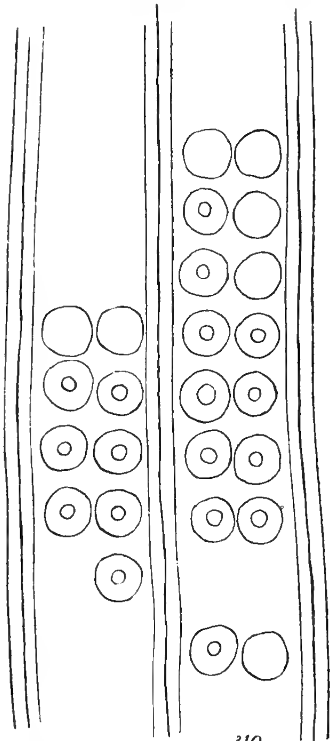
* In letter of McGee, September 14, 1887.



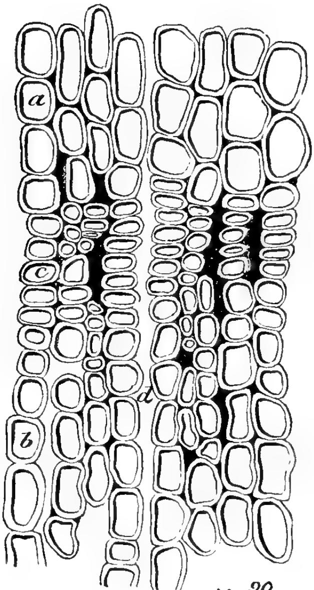
1. × 90/1



2. × 90/1



3. × 310/1



4. × 90/1

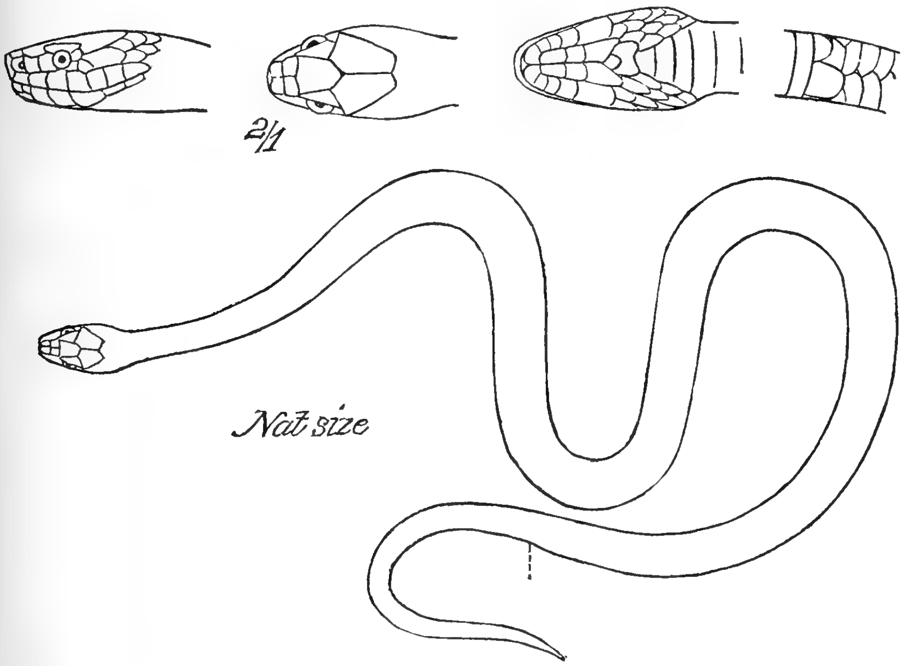
Cupressinoxylon elongatum. New species of fossil wood. (Page 7.)

(Explanation of plate on page 8.)

DESCRIPTION OF STORERIA DEKAYI, VAR. ANOMOLA.

BY A. DUGÈS.

J'ai trouvé ce petit serpent à Orizaba (Mexique) sous une pierre, au bord d'un ruisseau, dans un endroit, extrêmement humide et d'une végétation tropicale. Il était très-vif, et en le prenant il laissa échapper une sécrétion dont la fétidité ressemblait à celle des tropidonotes.



Storeria Dekayi, var. anomala, DUGÈS.

Description.—Longueur totale, 0.279^{m}; tête, 0.010^{m}; corps, 0.216^{m}; queue, 0.053^{m}. Dix-sept rangs d'écailles toutes bien carênées; celles qui touchent les lamelles ventrales, plus grandes que les autres; deux pores à l'extrémité qui est échancrée. Gastrostèges, 145. Anale divisée. Urostèges doubles, 45. Une pointe aiguë à l'extrémité de la queue. Frénale absente. Préoculaire, 1; post-oculaires, 2. Labiales, 7 en haut et 7 en bas. Parties supérieures brunes avec deux lignes parallèles de points noirâtres le long du milieu du dos; vertex un peu plus foncé. Parties inférieures blanches. Iris brun. Langue couleur de chair.

Cet ophidien porte à gauche 3, et à droite 2, post oculaires. Derrière la post-oculaire inférieure il y a une écaille qui touche cette post-oculaire et un peu la supérieure, la première temporale et les $4^{\text{ème}}$ et $5^{\text{ème}}$

supérolabiales. La première temporale est grande, mais les deux autres ne diffèrent pas des écailles des côtés du cou. L'anale est partagée en trois, parce que du côté gauche une de ses moitiés est divisée en travers. La rostrale est plus large que haute.

Je trouve à ce serpent beaucoup de ressemblance avec *Storeria dekayi* Holbr., mais sa coloration est plus uniforme: il n'y a aucune tache à la tête, ni sous le ventre, et la portion comprise entre les deux lignes dorsales longitudinales n'est pas plus claire que le reste; sur les flancs on distingue avec peine la trace d'une ligne brune longitudinale. La présence, indiquée dans la figure, de *six* plaques sous-maxillaires; les préanales au nombre de *trois;* la petite écaille temporale accessoire me paraissent de simples anomalies insuffisantes pour établir une espèce, et c'est là ce qui m'a déterminé à présenter cet individu comme une simple variété de *St. dekayi.*

ALF. DUGÈS.

GUANAJUATO, *décembre* 1887.

RECENT DETERMINATIONS OF FOSSIL PLANTS FROM KENTUCKY LOUISIANA, OREGON, CALIFORNIA, ALASKA, GREENLAND, ETC., WITH DESCRIPTIONS OF NEW SPECIES.

BY LEO LESQUEREUX, COLUMBUS, OHIO.

[Compiled and prepared for publication by F. H. KNOWLTON, Assistant Curator Botany and Fossil Plants, U. S. National Museum.]

(With Plates IV–XVI.)

The fossil plants of which the following determinations have been made belong to collections of greater or less extent that have been sent to the U. S. National Museum from various parts of the country. While most of the species are well known, a large percentage of species new to science have been detected, particularly in the collections from Oregon and California.

Following is an enumeration of the various localities from which these plants have been obtained, with an indication (when known) of the geologic horizon to which each belongs:

1. Boaz Station, Graves County, Ky.......Tertiary (Pliocene).
2. Wickliffe, Ballard County, Ky................Lower Eocene.
3. Van Horn's Ranch, John Day Valley, Oregon.......Miocene.
4. Cherry Creek, Wasco County, Oregon..............Laramie.
5. Campbell's Quarry, Cross Lake, La...................Laramie.
6. McLee's, near Mansfield, La..........................Laramie.
7. Coral Hollow, Alameda County, Cal................Miocene.
8. Monte Christo Tunnel, Summit of Spanish Peak, Cal., Miocene.
9. Shasta County, Cal.......................................Miocene.
10. Lassen County, Cal.......................................Eocene.
11. Cape Lisbourne, Alaska...........................Neocomian.
12. Greenland...Miocene.
13. Contra Costa County, Cal..................Upper Miocene.
14. Sam's Creek, Jackson County, Oregon...........Unknown.
15. "Fossil Point, P. Y. Sheet"...........................Unknown.
16. Selma, Cherokee County, Tex.........................Unknown.
17. Bridgetown, N. J..Pliocene.
18. Fremont Expedition...Oolite?
19. "Fortieth Parallel Collection"........................Unknown.
20. Miscellaneous localities.......................Mostly unknown.

1.

Specimens from Boaz Station, Graves County, Ky. Collected by Dr. R. H. Loughridge of the Kentucky Geological Survey. Specimens preserved in a white or purple plastic clay, of the Lagrange group of Safford, probably Upper Tertiary.

Ficus multinervis Heer. Plate IV, figs. 2, 3.

These leaves have the exact nervation of the species as figured in Ett. Foss. Fl. v. Bilin, part i, Pl. XX, figs. 5, 6, especially like the en-

larged fig. 6*b*. The form of the leaf (fig. 2) is like that in Heer Fl. Tert. Helv., vol ii, Pl. LXXXI, fig. 6, agreeing also by the nervation. The fragment (fig. 3) has epiphytes much like *Xylomites aggregatus* Heer, Fl. Foss. Arct., vol. vi, Pl. XXIX, figs, 11, 11*b*. Catalogue number, 2638.

Laurus californica Lx. Plate IV, fig. 1.

Differs from the leaves of the species as described and figured (Cret. and Tert. Fl., p. 252, Pl. LVIII, figs. 6–8) in the more obtuse leaf. It is most like *Persea amplifolia* Sap. (Foss. Fl. of Meximieux, p. 239 [109], Pl. XXVII [xxviii], fig. 1–4). The leaves are larger in the European species and the secondaries and intermediate tertiaries stronger. Catalogue number, 2496.

Sapindus falcifolius Al. Br. Plate IV, fig. 4.

One specimen; Museum number, 2604.

Quercus *cf.* **cuspidata** (Rossm.) Ung. Catalogue number, 2573.

Quercus neriifolia Al. Br. Catalogue number, 2574.

2.

Specimens in Claystone from the Lower Eocene or lignitic group. Collected at Wickliffe, Ballard County, Ky., by Dr. R. H. Loughridge of the Kentucky Geological Survey.

Myrica elænoides, n. sp. Plate IV, fig. 5.

Leaf long, linear-lanceolate, entire, gradually tapering at base and somewhat decurring upon a short petiole, acute or acuminate (point broken); secondaries close, numerous, oblique, camptodrome; tertiaries intermediate, more inclined, anastomosing at right angles on both sides, reticulation very small, quadrate.

The form of this fine leaf is like that of a *Salix* (*e. g.*, *S. tabellaris* Lx. Miss. Fl., Pl. XVII, fig. 4), being a little narrower and more gradually narrowed to the petiole. The nervation is also analogous, but secondaries are more numerous and more oblique. By its form also the leaf has great affinity to *Quercus elæna* Ung. (especially as figured in Sap. Etudes iii, Pl. II, fig. 20, for the form, and pl. V, fig. 2 for the nervation), differing, however, by the very close small quadrate, punctate areolation. The aspect is also that of a *Laurus*, the areolation being that of *Laurus canariensis* Willd. It appears more likely referable to *Myrica*, the tertiary nervation being that of *Myrica aquensis* (Sap. Etudes iii, Pl. VII, fig. 7), and the form that of *M. hakeæfolia* (Sap. Etudes ii, Pl. V, fig. 9).

Sapindus angustifolius Lx.

Two specimens; Museum number, 2599.

Sapindus dubius Ung.

Eight specimens; Museum number, 2603.

Myrica Copeana Lx.

One specimen; Museum number, 2521.

Juglans rugosa Lx.

One specimen; Museum number, 2490.

Salix angusta Al. Br.

Two specimens; Museum number, 2588.

Salix media Heer.

Three specimens; Museum number, 2593.

Quercus Saffordii Lx. Plate v, figs. 1–3.

The description of the species is given in Geol. Tenn., p. 427, pl. K, figs. 2*a*, 2*b*, 2*c*.

It is comparable, indeed much like the small leaves referred to *Quercus furcinervis* Rossm. by Engelhardt (Fl. v. Leitm., p. 402 [62], Pl. xxv [x], figs. 10–19), which differs from the American form in having the secondaries more regular, at equal distances, and not separated by tertiaries, which do not correspond to teeth of the borders but are shorter, camptodrome, or ending in the areolation. From the description of Engelhardt and the figures of *Quercus furcinervis* in Ett. Foss. Fl. v. Bilin, Th. I, Pl. xvi, figs. 11, 12, *Quercus Saffordii* Lx. appears to be a mere variety of that very common and variable species.

Ten specimens; Museum number, 2571.

Porana species.

One specimen; Museum number, 2630.

3.

Specimens from Van Horn's ranch, John Day Valley, Oregon, collected by Capt. Charles Bendire, U. S. Army. The age of these beds is Miocene, probably latest Miocene.

Magnolia lanceolata Lx.

One specimen; Museum number, 2514.

Magnolia Inglefieldi Heer. Fl. Art. I, p. 120, Pl. xviii, figs. 1–3.

I refer the specimen to the species with some doubt, as Heer describes the leaves as having a thick medial nerve, being coriaceous and the surface polished. In these leaves, which are, however, impressions of the lower surface, the medial nerve is comparatively thin, though thick, proportionally, to the secondaries; the texture is not coriaceous and the surface is not polished. The nervation is, however, of the same type; the secondaries distant; the areas broad, the nervilles or tertiaries distinct, and the areolation very small, quadrangular, pitted by points as in fig. 3*a* of Heer; it must be remarked also that fig. 1 of Heer has not the medial nerve broader than of the leaf in specimen.

One specimen; Museum number, 2513.

Liquidambar protensum Ung. Plate viii, fig. 3.

The leaf has the characters of the species as represented in Heer, Fl. Tert. Helv., p. 8, Pl. iii, fig. 11. It is, however, deformed by maceration, the medial nerve of the middle lobe being displaced from its point of

conjunction with the lateral ones; and the borders being all totally erased so that their characters can not be observed except at the lower borders of the left lobe, which is serrate. Heer describes the leaves as coriaceous. These specimens show them to be thin and pellucid, an appearance, however, which may have been produced by maceration. In comparing this leaf with that of *Acer dimorphum*, one can but find between them a remarkable analogy of characters, the lower lateral lobes, though comparatively very small in Pl. IX, fig. 1, being marked on the lower side each by a few small teeth or like serrate, while the nervation of the upper lateral lobe is about of the same character.

Two specimens; Museum number, 2504.

Liquidambar europeum Al. Br.

One specimen; Museum number, 2503.

Acacia oregoniana, n. sp. Plate V, fig. 4.

Legume long-pedunculate, 8^{cm} long, $1\frac{1}{2}^{cm}$ broad, linear, narrowed at one end to a long pedicel, obliquely rounded at the other to a pointed one-sided beak; bearing 8 to 9 small oval seeds more or less distant, joined to the upper borders by simple filaments; borders, narrow; legume, flattened by compression, membranous.

The legume is larger than any of those figured by Heer (Fl. Tert. Helv., Pls. CXXXIX and CXL), except the fragment of *A. microphylla*, Pl. CXL, fig. 8. Its form is that of *Cercis occidentalis*, but the borders are not winged by a membrane.

Two specimens; Museum number, 2412.

Acer Bendirei, n. sp. Plate V, fig. 5, VI, fig. 1, VII, fig. 1, VIII, fig. 1. *Acer trilobatum productum* Al. Br. Lesquereux in Cret. and Tert. Fl., p. 253, Pl. LIX, figs. 1–4.

Leaves large, palmately trilobate, cordate or round auricled at base, with a very long, thick petiole; lobes long and comparatively narrow, the medial twice as long as the lateral ones, which are erect, at a very acute angle of divergence or even curved inward, dentate from the base; teeth either large and long, sharply acuminate, or shorter, turned outward and merely pointed.

The leaf, fig. 1, Pl. VI, has no auricle at its base, and the teeth of the lobes are large and sharply acuminate; thus, it seems at first to belong to a marked variety or a different species. But that of fig. 5, Pl. V, has some of the teeth also sharply acuminate, and at base a short auricle or rather a prolongation of the lamina lower than the point of union of the primary nerves. The petiole is thick, inflated, and split at base by compression.

Acer trilobatum, var. *productum*, Al. Br., has the medial lobe nearly as long as in those of this species, which evidently differs by the base of the leaves, cordate or auriculate, by the narrow very oblique lateral lobes sometimes curved inward, and the sharply acuminate teeth. *Acer Heerii* (Mass. Flor. Foss., p. 345, Pl. XVI, and XVII), a synonym of *A. trilobatum productum* Al. Br., is represented with leaves sometimes

auricled at base, but the lateral lobes are open with short even obtuse teeth of a far different facies.

Eleven specimens; Museum number, 2413.

Acer dimorphum, n. sp. Plate IX, fig. 1.

Leaves large, palmately three-lobed; lobes oblong, lanceolate, distantly obtusely dentate, the lateral shorter, half open, prolonged at base into two short triangular minutely dentate lobes or large teeth.

The leaf has a peculiar facies, the medial lobe being large and long, obtusely dentate, with few distant secondaries, and also few distant obtuse teeth, while the lateral lobes open, diverging 50 degrees from the medial nerve, have short obtuse teeth, numerous camptodrome or craspedodrome secondaries, and are prolonged at their base into small lobes opening like wings on both sides of the medial nerve.

The relation of this leaf is with *Acer grosse-dentatum* Heer Fl. Tert. Helv., iii, 54, Pl. CXII, fig. 21), from which it differs by the pecurliar characters of the lateral lobes.

Two specimens; Museum number, 2415.

Acer, fruits of. Plate VI, figs. 2, 3; VII, fig. 2.

Seeds long and large-winged, broad-margined on the outer side; nucleus large, apparently round (crushed).

The seeds are comparable to those of *Acer dasycarpoides* Heer (Fl. Tert. Helv., vol. iii, Pl. CLV, fig. 7), the wings being, however, rounded, not emarginate at the middle. They most resemble those of *Acer dasycarpum* Ehrh. of the eastern slope of the United States, and those of *A. macrophyllum* Pursk, of California. The margin of the outer side is, however, less enlarged and less compact at base in the living than in the fossil seeds. These are most probably referable to the preceding species.

Three specimens; Museum number, 2417.

Acer, branches of?

Five specimens; Museum number, 2418.

Sapindus angustifolius Lx.

Two specimens; Museum number, 2598.

Rhus Bendirei, n. sp. Plate IX, fig. 2.

Leaf compound, leaflets oblanceolate, narrowed from below the middle to a short petiole, tapering above to an acute point, serrate to near the base; medial nerve stout; secondaries parallel, curved in traversing the blade; branching near the borders, craspedodrome with their divisions. The leaflet is apparently a terminal one, longer and more narrowed downward than the lateral ones. To these I refer a small oblong lanceolate leaflet, rounded in narrowing rapidly to the point of attachment, very short petioled, with small teeth, and areolation identical. The substance of the leaves is membranous; the areolation distinct, very small, irregularly round or angular.

Three specimens; Museum number, 2582.

Berchemia multinervis Al. Br.

Two specimens; Museum number, 2438.

Aralia! pungens? Lx.

One specimen; Museum number, 2428.

Aralia! whitneyi? Lx.

One specimen, Museum number, 2429.

Andromeda? (Leucothœ) crassa, n. sp.

Leaves thick, coriaceous, entire, narrowly oval, oblong or elliptical, obtuse, petioled. Secondaries camptodrome. This leaf resembles those of some *Quercus*, *e. g.*, *I. chlorophylla* Ung.; but the secondaries are not thin and indistinct, but comparatively thick, well marked, somewhat distant, camptodrome, the borders of the leaf being reflexed and the end of the secondaries not seen. Its greatest affinity is with the leaf figured by Unger (Sylloge, iii, p. 36, Pl. XII, fig. 11) as *Andromeda tristis*, a variety, according to Schimper, of *A. protogaea*. The leaf is 5^{cm} long, 22^{mm} broad at the middle, with a petiole a little more than 1^{cm} long; the secondaries, 6 pairs, diverge 40 to 50 degrees from the medial nerve.

One specimen; Museum number, 2422. On same stone with numbers 2480 and 2614.

Cassia phaseolites? Ung.

Two specimens; Museum number, 2455.

Paliurus columbi Heer.

One specimen; Museum number, 2542.

Myrica (Aralia) lessigii? Heer.

Two specimens; Museum number, 2522.

Porana Bendirei (Ward) Lx. Plate VIII, fig. 4. *Marsilia Bendirei* Ward. Sketch of Paleobotany. Fifth Ann. Rept. Director U. S. Geological Survey, 1883–'84. p. 446.

Calix large, quadrilobate, lobes broadly oval, obtuse; the lateral shorter, more enlarged, reniform, connate to above the middle, nerves thin, diverging from a central small oval point.

The calix is nearly 4^{cm} wide in its length, 3^{cm} broad; the largest of the sepals being 2^{cm} long, $1\frac{1}{2}^{cm}$ broad at the middle. The species is much like *P. œningensis* (as figured by Weber in Paleontog., vol. ii., Pl. XXIV, fig. 2), a species which, according to Schimper, is not the true *P. œningensis* and which differs from the American species by having the sepals free to the base or to near the center, smaller and round. That plant of Weber is apparently what is described as *Hydrangea sagoriana* Ett. (Foss. Fl. v. Sagor, part iii, p. 18, Pl. XXXI, fig. 3).

Two specimens; Museum number, 2541.

Carpites fragariæformis, n. sp.?

One specimen; Museum number, 2442.

Salix varians Göpp.

One specimen; Museum number, 2596.

Salix raena ? Heer.

Two specimens; Museum number, 2594.

Salix Engelhardti, n. sp. Plate VIII, fig. 2.

Leaves oblanceolate or narrowly obovate, rounded to the point (broken), gradually narrowed to the base; borders serrate with short appressed teeth; medial nerve narrow, secondaries equidistant, camptodrome, and parallel from the base.

The leaf, 8^{cm} long, 3^{cm} broad toward the apex, is gradually narrowed to the petiole. Except for the secondaries, which are open at an angle of divergence of 50 to 60 degrees curved in passing toward the borders, the areolation is obsolete. It is comparable by its form, the dentation of the borders, and its nervation to the living *Salix discolor* Muhl.

Two specimens; Museum number, 2589.

Salix amygdalifolia Lx.

Two specimens; Museum number, 2587.

Quercus Horniana, n. sp. Plate V, fig. 6.

Leaves small, subcoriaceous, elliptical oblong, narrowed upward to a point, rounded to a short, thick petiole, obtusely dentate; medial nerve thin; secondaries at an acute angle of divergence, simple, straight to the point of the teeth, numerous alternate and parallel; the two lowest pairs more open, slightly curved back, and with few branches.

The angle of divergence of the secondaries is 30 degrees; they are comparatively thick, less than 5^{mm} distant. The appearance of the leaf is like that of a *Castanea*, but no species of this genus has the leaves so short dentate and the secondaries ramified. It is most like *Dryophyllum* (*Quercus*) *Bruneri* Ward (Synop. of the Fl. of the Laramie Group, Pl. XXXVII, figs. 6–9), from which it differs essentially by the small size, the secondaries straight, even slightly curved backward rather than upward and the lowest ramified. It is also comparable to *Quercus densiflora* Hook & Arn. (Bot. Beechey, p. 391, of California), but has the leaves comparatively shorter, not tapering, but rounded at base.

One specimen; Museum number, 2556.

Quercus pseudolyrata Lx. Plate X, fig. 1. (Foss. Pl. of the Aurif. Gravel, p. 8, Pl. II, figs. 1–2.)

The leaves are cut into deep, oblong linear or lanceolate lobes, pointed or acuminate. With this exception the description *l. c.* is correct.

Twelve specimens; Museum number, 2565.

Quercus pseudolyrata Lx., var. **acutiloba** n. var. Plate XI, fig. 1.

Four specimens; Museum number, 2566.

Quercus pseudolyrata Lx., var. **angustiloba** n. var. Plate XI, fig. 2.

One specimen; Museum number, 2567.

Nov. 8, 1888.

Quercus pseudolyrata Lx., var. **brevifolia**, n. var. Plate x, fig. 2.

One specimen; Museum number, 2568.

Quercus pseudolyrata Lx., var. **latifolia**, n. var. Plate XII, fig. 1.

Two specimens; Museum number, 2570.

Quercus pseudolyrata Lx., var. **obtusiloba**, n. var. Plate x, Fig. 3.

Two specimens; Museum number, 2569.

Populus glandulifera Heer.

Is right according to Schimper's description and also to my figures of the species in "Cret. and Tert. Fl." Pl. XLVI, fig. 4, which is better than any of Heer's (Fl. Tert. Helv., Pl. LVIII), the secondaries being at a much greater distance from the primaries as figured by Heer, and also much thinner.

One specimen; Museum number, 2545.

Populus mutabilis Heer.

One specimen; Museum number, 2547½.

Fagus castaneæfolia Ung.

Two specimens; Museum number, 2466.

Carya elænoides Heer.

One specimen; Museum number, 2446.

Carpinus grandis Ung.

One specimen; Museum number, 2440.

Carpinus pyramidalis Heer.

One specimen; Museum number, 2439.

Alnus Kefersteinii Ung.

Four specimens; Museum number, 2420.

Ulmus plurinervia Ung.

Two specimens; Museum number, 2620.

Ulmus californica Lx.

One specimen; Museum number, 2621.

Ficus? oregoniana, n. sp. Plate IX, fig. 3.

Leaves ovate, taper pointed, enlarged at and below the middle; rounded to a short thick petiole, entire, medial nerve narrow, secondaries alternate, distant, much curved in passing to the borders, camptodrome, separated by thin tertiaries composing the areolation in anastomosing with oblique nervilles, meshes very irregular.

The areolation is somewhat indistinct, the petiole is short, much enlarged at its point of attachment, scarcely 1^{cm} long. The relation of this leaf is with *Ficus mararignæ*, (Mass. Fl. Foss., Pl. XXXI, f. 7), which is smaller, less enlarged in the lower part, but apparently with the same kind of nervation.

Two specimens; Museum number, 2475.

Planera Ungeri Ett.

Two specimens; Museum number, 2534.

Platanus Raynoldsii Newby.

Two specimens; Museum number, 2539.

Platanus nobilis Newby.

One specimen; Museum number, 2538.

Platanus aceroides (Göpp) Heer. Plate v, fig. 7.

Two specimens; Museum number, 2535.

Smilax Wardii, n. sp. Plate XIII, fig. 1.

Leaf long, linear-lanceolate, gradually narrowed above to an acute point, hastate sagittate at base, 5 to 7 nerved from the base of the medial nerve.

The blade of leaf is about 14^{cm} long, 2^{cm} broad below the middle, with two pairs of secondaries or lateral nerves emerging from the base, the inner more distinct at an acute angle of divergence, passing up in the middle of the areas, parallel to the midrib and acrodrome, the outer pair emerging from the base nearly at right angles dividing at the middle in two branches, the one directed upward from which depends the the outer, thin secondaries, which follow close to the borders, being gradually effaced above, the other descending into the auricle by branchlets, there curving down and around, anastomosing in following the borders, with thin nervilles emerging from the base of the midrib. The areolation is made of thin nervilles oblique to the secondaries and crossing obliquely in rhomboidal meshes.

Related by its prolonged rounded auricle to the numerous sagittate species of *Smilax*, the leaf differs from all by the very long linear lanceolate blade, the obtuse auricles descending 2^{cm} below the base of the midrib, diverging from each other at an angle of 55 to 60 degrees.

Three specimens; Museum number, 2613.

Phagmites oeningensis Al. Br.

Six specimens; Museum number, 2530.

Glyptostubus Ungeri Heer.

Fifteen specimens; Museum number, 2480.

Sequoia Nordenskiöldi Heer.

Two specimens; Museum number, 2610.

Sequoia Langsdorfii Heer.

Two specimens; Museum number, 2607.

Taxodium distichum miocenum Heer.

Six specimens; Museum number, 2614.

4.

Specimens from Cherry Creek, Wasco County, Oregon, collected by Capt. Charles Bendire, U. S. Army. Age probably Eocene (Laramie group).

Rhamnus obovatus Lx.

Three specimens; Museum number, 2579.

Rhamnus Dechenii Web.

Two specimens; Museum number, 2575.

Rhamnus Cleburni Lx., var.

A large fragment, merely differing from the normal form by the nervilles more oblique nearly at right angles to the medial nerve and slightly more distant. The form of the leaf, of which one side is preserved, is conformable to that of the figures of the species in Lesqx. (Cret. and Tert. Fl., Pl. LIII, figs. 1, 2), made from specimens from Golden, Colorado.

One specimen; Museum number, 2580.

Magnolia lanceolata Lx.

One specimen; Museum number, 2515.

Andromeda protogaea Ung.

One specimen; Museum number, 2423.

Aralia digitata Ward. Plate XI, fig. 4.

Leaves small, palmately five-lobed to the middle, trinerved from above the base, either cuneiform, subcordate, or prolonged into a short tridentate pelta; lobes linear-lanceolate, denticulate in the upper part, separated by narrow, obtuse sinuses; secondaries numerous, camptodrome or craspedodrome, entering the teeth in the upper part of the lobes.

This very fine species is represented by four nearly entirely preserved leaves in Ward's Synop. of the Flora of the Laramie Group, Pl. XLVIII, figs. 10–12, and Pl. XLIX, fig. 1. From these figures the leaves appear extremely variable in size, the whole leaf (fig. 12) being only $8\frac{1}{2}^{cm}$ long, including a thick petiole more than 2^{cm}, with lobes 3^{cm} long and 1^{cm} broad, while another figure (Pl. XLIX, fig. 1) represents part of a leaf at least 16^{cm} long with lobes 10^{cm} long and 5^{cm} broad above the middle, the lobes being generally slightly narrowed from the upper part toward the sinuses.

The relation of this species is like that of *A. gracilis* and *A. notata* Lesqx., of the Laramie group and especially with *A. Saportanea* Lesqx., of the Dakota group. The specimens from Cherry Creek have the lower part of the leaf destroyed.

One specimen; Museum number, 2424.

Aralia notata Lx.

One specimen; Museum number, 2426.

Ilex longifolia Heer.

One specimen; Museum number, ——.

Diospyros lancifolia Lx.

One specimen; Museum number, 2461.

Cornus ferox Ung.

One specimen; Museum number, 2452.

Carpites cinconæ, n. sp.

One specimen; Museum number, 2440.

Populus monodon Lx.

The leaf has the form of those of *P. Gaudini* Fisch-Oost. and also the size, but the nervation is more open and the leaf is not acuminate. It is also coriaceous, a character not indicated by Heer. The species appears to be an American form, perhaps identical, or at least closely allied, to the European *P. Gaudini*. It has by its nervation a relation to *Populites Gasparinii*, Massal (Flor. Foss., Pl. XXVIII, fig. 3), and also to the leaf or fragment figured by Heer (Fl. Foss. Arct., vol. I, Pl. L, fig. 7) as *Phyllites evanescens*, especially like it by the nervation more open or nearly at right angles in the upper part.

Two specimens; Museum number, 2546.

Salix Schimperi, n. sp. Plate XIII, fig. 5.

Leaves membraneous, large, lanceolate, gradually acuminate, narrowed in rounding to the subcordate base, minutely serrulate all around; nerves thin, open.

The nervation and areolation of this fine leaf are distinctly of a Salix. The membraneous leaf is thin and in being wetted distinctly shows the characters of the nervation and areolation. It is $15\frac{1}{2}^{cm}$ long, $3\frac{1}{2}^{cm}$ broad at a short distance above the base, from which point it is gradually narrowed and tapers by a curve to a short petiole, being subcordate at base, as in *S. cordato lanceolata* of Al. Br., figured by Heer (Fl. Tert. Helv., vol. ii, Pl. LXVIII, fig. 5). The petiole is apparently thick, but is mostly covered. The crenulations of the borders though distinct are very small, turned upward as in *S. Lavateri* Heer (Fl. Tert. Helv., vol. ii, Pl. LXVI, figs. 1–12). The leaf is not inclined nor curved, but perfectly equilateral.

The leaf is clearly related to *S. cordato-lanceolata* Al. Br., but it is twice as large, more distinctly crenulate, thin, membraneous, and the base is less broadly cordate.

Heer remarks that no fossil Salix leaves of this character have as yet been discovered, and that Braun's species needs confirmation to fix the character of the subcordate base, which may be only the variation of a single leaf. No other leaf of Salix has been found as yet with this one except *S. varians*, which has the leaves sometimes as large as this, but always narrowed to the base and not rounded and subcordate.

Two specimens; Museum number, 2595.

Castanea Ungeri ? Heer.

Three specimens; Museum number, 2447.

Quercus furcinervis (Rossm.) Ung.

One specimen; Museum number, 2554.

Quercus lonchitis Ung.

Three specimens; Museum number, 2557½.

Quercus fraxinifolia Lx.

One specimen; Museum number, 2552.

Quercus Olafseni Heer.

One specimen; Museum number, 2559.

Quercus platania Heer.

One specimen; Museum number, 2563.

Juglans Leconteana Lx.

One specimen; Museum number, 2487.

Juglans rhamnoides Lx.

Two specimens; Museum number, 2488.

Juglans rugosa Lx.

Two specimens; Museum number, 2489.

Juglans vetusta Heer.

There is no difference at all, either in the form, the size, or the nervation, between this leaf and that figured in Heer, Fl. Tert., vol. iii, Pl. cxxvii, fig. 41, described, p. 90, as leaves petioled, very entire, oblong, obtuse at apex; secondaries ten to twelve pairs. Heer says that these leaves may represent a variety of the very variable *Juglans acuminata* which, under the names of *Juglans rugosa* Lx., is quite as common in the Laramie Group as *J. acuminata* is in the European Tertiary. The secondaries are very open, nearly at right angles, the reticulation distinct, in large polygonal areoles, formed by subdivisions of intermediate thinner tertiaries or nervilles.

One specimen; Museum number, 2636.

Juglans denticulata Heer.

One specimen; Museum number, ——.

Phyllites wascoensis, n. sp. Plate xiv, fig. 3.

Leaves comparatively large (the lower half of one only is preserved), oval or ovate, cuneiform and abruptly rounded, truncate at base; secondaries oblique, straight in passing toward the borders, parallel, joined by strong nervilles, obliquely directed upwards.

The leaf, broken 6^{cm} from the base, is at the point of fracture 6^{cm} broad. The fragment has six pairs of secondaries, the three lower coming close together toward the base, where they are scarcely 4^{mm} distant, while above the distance is 1 to 1½^{cm}. The distribution of the secondaries and of the nervilles tending upward, finds analogy in some leaves

of Cornus, like *C. Studeri* Heer, of the Fl. Tert. Helv., vol. iii, Pl. CV, figs. 18–21, or the European *C. mas.* Linn., species in which the lower secondaries are often more proximate toward the base; but as the upper secondaries are directed toward the borders and branching, the fragments can not be referable to Cornus. It might be compared also to species of Rhamnus, but the lowest secondaries branch and curve in bows along the borders, a character which is at variance with that of the secondary nervation of the leaves of that genus.

One specimen; Museum number, 2633.

Ficus tenuinervis Lx.

The specimen of Cherry Creek is better preserved than the small fragment of this species in Lesqx., Cret. and Tert. Fl., p. 164, Pl. XLIV, fig. 4. The leaf is large, cordiform, rounded at apex, apparently obtuse or obtusely pointed, largest below the middle and rounded to the sub. cordate or emarginate base. The secondaries are distant, parallel, much curved, following close to the borders in simple areoles joined by strong nervilles at right angles forking obliquely or at right angles at the middle, subdivided again into small irregular polygonal areoles. The characters of nervation, as well as the primary reticulation, is exactly represented in *l. c.*, fig. 4. But the leaf of Cherry Creek is more than twice as large, 7 to 8^{cm} long, and as broad below the middle, with five pairs of secondaries at a broad angle of divergence.

One specimen; Museum number, 2479.

Equisetum Hornii, n. sp.

Stems thick with branches $1\frac{1}{2}$ to 2^{cm} in diameter, not compressed; one stem compressed 3^{cm}; articulations distant; sheaths appressed, short, merely obtusely dentate; teeth generally obsolete and destroyed, lingulate, connate to near the inflated apex; articulations under it or at its base marked by round scars of leaves distinctly and deeply striate; stems nearly smooth or obscurely striate; diaphragm thick, often left separated from the crushed stems, coriaceous.

The largest fragment preserved of this species is 11^{cm} long; the distance between the articulations $8\frac{1}{2}^{cm}$; that of the branches $1\frac{1}{2}$ to 2^{cm} long, according to the size. The width of the striæ—which are flat in the lower part, grooved in the upper—is 1 to $1\frac{1}{4}^{mm}$. The sheaths seen upon a fragment of specimen, the inside of which is preserved, is 2^{mm} long, fringed with oblong and pointed short teeth. The roots are thick, $1\frac{3}{4}^{cm}$ in diameter.

Except *Equisetum procerum* Heer (Fl. Tert. Helv., vol. iii, p. 258, Pl. CXLVI, fig. 1), no species described from the Cenozoic time may be compared to this. From *E. procerum* it differs merely by the sheaths being longer, the teeth and striæ much narrower. The teeth of the sheaths, as described by Heer, are short, muticous. The fragments from Oregon are apparently merely branches, at least those which have not been flattened by compression, two of which are narrowed to the base and

obtuse-like branches. The largest fragment, flattened, 3^{cm} in diameter, is as large as that figured by Heer. The character taken from the size of the stem is of no great value; these fragments may represent the same species as that of Heer, for one fragment (No. 733) has a whole sheath and the stem above, partly preserved, is striate. It may be also the species mentioned or described as *E. robustum* Newb'y (Boston Journ. Nat. Hist., 1863).

Forty-one specimens; Museum number, 2464, 2465.

Lygodium neuropteroides Lx.

According to Gardner and Ett. this is *L. Kaulfussi* Heer (Flor. von Skopau; Beiträge zur näher. Kenntniss d'Sachs Thüringen Braunkohle, p. 409 [2], Pl. VIII, fig. 21; Pl. IX, fig. 1, 1861). Heer's species is made of a mere fragment of a lobe, which appears dentate and linear with lateral nerves much more oblique and distant so that the reference of the American leaves to the European species is very doubtful. Schimper has not admitted or described it in his Paleontologie Vegetale.

Sixty specimens; Museum number, 2505.

Pteris subsimplex Lx.

One specimen; Museum number, 2634.

5.

Specimens from Campbell's Quarry, Cross Lake, La. Collected by Mr. L. Johnson. Age probably Eocene, the equivalent of the Lagrange group of Safford (Laramie group?).

Sapindus angustifolius Lx.

One specimen; Museum number, 2600½.

Sapindus caudatus Lx.

One specimen; Museum number, 2601.

Sapindus coriaceus Lx.

One specimen; Museum number, 2602.

Magnolia laurifolia Lx.

The leaf is fully preserved, the borders only somewhat erased. It is 19^{cm} long, gradually enlarged from the rounded base to below the apex, and there rapidly tapering to the obtusely pointed apex. It has twenty secondaries, all parallel, equidistant as in Miss. Fl., Pl. XX, fig. 1, having the same degree of divergence, 50 degrees, as in fig. 2.

Three specimens; Museum number, 2517.

Laurus socialis Lx.

One specimen; Museum number, 2501.

Laurus utahensis Lx.

Two specimens; Museum number, 2502.

Rhamnus Cleburni Lx.

One specimen; Museum number, 2581.

Rhamnus Eridani Ung.

One specimen; Museum number, 2578.

Carya antiqua ? Ny.

Eleven specimens; Museum number, 2443.

Quercus angustiloba Al. Br.

One specimen; Museum number, 2551.

Quercus Moorii? Lx. The species is figured from three specimens in Miss. Foss. Flo., Pl. XVI, figs. 1–3. Of these specimens none are alike; they all differ much by the size, the more or less curved nerves, being only identified by the peculiar short blunt teeth, separated by very shallow or straight sinuses. In this specimen the leaf greatly differs by the acuminate apex, while none of the three specimens of the Mississippi has the apex preserved, only in one, fig. 3, the apex being erased, appears blunt. Considering the affinity of nervation and identity of dentation, I refer the leaf to the species of the Mississippi Flora, which still has other species identical with those of Campbell's Quarry, Cross Lake, near Shreveport, La.

Ficus goldiana Lx.

One specimen; Museum number, 2471.

Ficus goldiana Lx., var.

One specimen; Museum number, 2472.

Ficus spectabilis Lx.

Three specimens; Museum number, 2476.

Phragmites œningensis Al. Br.

One specimen; Museum number, 2532.

6.

Specimens from McLee's, 2 miles north of Mansfield, La. Collected by Mr. L. Johnson. Age, the same as the preceding lot of specimens.

Magnolia laurifolia Lx.

Two specimens; Museum number, 2516.

Ficus spectabilis Lx.

Two specimens; Museum number, 2476.

Aralia, fragment.

One specimen; Museum number, 2431.

Platanus Guillelmæ Göpp.

7.

Specimens from the north side of Corral Hollow, Alameda County, Cal. Collected by Mr. H. W. Turner.

Specimens in soft hardened white clay, with conchoidal fracture, representing only small fragments of leaves. The age is Miocene.

Laurus californica Lx.

Eight specimens; Museum number, 2494.

Laurus resurgens? Sap.

Twelve specimens; Museum number, 2578.

Laurus Furstenbergii Al. Br.

Seven specimens; Museum number, 2597.

Persea pseudo-carolinensis Lx.

One specimen; Museum number, 2628.

Persea punctulata, n. sp. Plate XIV, fig. 1.

Leaves oblanceolate, pointed at apex, gradually narrowed to the short petiole, thickish but not coriaceous, medial nerve strong, secondaries at an acute angle of divergence, curving in passing toward the borders, which they follow in a series of simple areoles, parallel, equidistant, about ten pairs; nervilles thin, numerous, at right angles, areolation irregularly polygonal or quadrangular, minutely punctulate.

The leaves have a great degree of likeness to those of *Persea pseudo-carolinensis* Lesqx. (in Fl. of the Gold Gravel of California, Pl. VII, fig. 1,) differing merely by being less rounded and narrower at the middle, longer subdecurring to the somewhat broad and round petiole. $1\frac{1}{2}$cm long. The divergence of the secondaries, which is about the same from the base upward, is 40 to 45 degrees. The essential character which indicates a separation of this species from the numerous specimens of Laurineæ which are represented in fragments and seen to constitute the whole flora of Corral Hollow, is the small points irregularly strewn upon the surface of the leaves appearing upon the epidermis as prominent, and under it, or upon the stone, as hollow. They look like points of hairs, but are not areoles of the leaves, as they are very small and irregular in position and distance. For the secondaries and the form of the leaves the species is comparable to *Laurus superba* Sap. (Etude II, 2, Pl. VII, fig. 4; III, 1, Pl. XV, fig. 5). The areolation differs in being much larger than it is marked in this last quoted figure.

Fifteen specimens; Museum number, 2529.

Rhus Henfleri? Heer.

One specimen; Museum number, 2583.

8.

Monte Christo Tunnel, summit of Spanish Peak, Cal. Collected by Mr. J. S. Diller. Age, Upper Miocene.

Acer Bendirei, n. sp. (See *ante*, p. 14.)

Four specimens; Museum number, 2414.

Laurus californica Lx.

One specimen; Museum number, 2495.

Myrica Ungeri Heer.

One specimen; Museum number, 2523.

Platanus dissecta Lx.

One specimen; Museum number, 2536.

Pterospermities spectabilis Heer.

One specimen; Museum number, 2550.

Carya bilinica Ung.

After due reconsideration I admit these leaves as referable to *Carya bilinica* Ung. The only difference, in considering the figures and descriptions of authors, is that in these leaves the secondaries which run high along the borders appear to end into the small acute teeth, with a branch passing under the teeth and continuing upward close to the borders and along them. The leaves rather look like the form which Unger has figured in Silloge, Pl. XVIII, as *Carya Ungeri* Ett. Same kind of nervation is seen in *Juglans cinerea*, which has, however, the secondaries less oblique.

One specimen; Museum number, 2444.

9.

Shasta County, Cal. Collected by Mr. J. S. Diller. Age, Miocene.

Persea Dilleri, n. sp. Plate XIII, figs, 2–4.

Leaves elliptical or oblong, gradually narrowed to a long petiole, obtusely pointed, entire and subcoriaceous; secondaries distant, parallel, thin, curving in traversing the blade and along the borders, the upper ones more curved.

The leaves about 8^{cm} long, 3^{cm} broad at the middle, have 7 or 8 pairs of secondaries at an angle of divergence of 40 degrees with a petiole 3^{cm} long, thick, enlarged at the point of attachment. Toward the apex of the leaves the secondaries are much curved, nearly in half circle, separated by tertiaries or rather nervilles at right angles to the medial nerve, forming by anastomoses very small quadrangular areolation as in species of *Persea* or *Laurus*. The lowest pair of veins are slightly more oblique than the others, which are all nearly opposite.

By the shape of the leaves, obtuse at apex, and by the areolation, the species is related to *Persea caroliniana*, var. *palustris* Chapman, from which it differs by the leaves being slightly shorter, the secondaries at a more acute angle of divergence, and the petiole longer by 1^{cm}.

Viburnum Wymperi Heer.

Specimen discarded.

Carya bilinica Ung.

Two specimens; Museum number, 2445.

Alnus Kefersteinii Al. Br.

One specimen; Museum number, 2420.

Ficus microphylla Lx.

One specimen; Museum number, 2473.

Ficus shastensis n. sp. Plate XI, fig. 3.

Leaf subcoriaceous, oval, acuminate, narrowed to an enlarged slightly winged petiole; secondaries obliquely curved, anastomosing in simple bows near the borders; areolation very small, closely granulose, verrucose.

The leaf 6^{cm} long, $3\frac{1}{2}^{cm}$ broad at the middle, is tapering upward to a short acumen, rounded and narrowed downward about in the same degree to a broad petiole 18^{mm} long, enlarged at the point of attachment. In shape and size the leaf is like that of *Persea Braunii* Heer (figured in Fl. Tert. Helv., vol. iii, Pl. CLIII, fig. 2), and the distribution of the secondaries is also the same. But the leaf is covered by a verrucose surface exactly similar to that of *Ficus scabriuscula* Heer *l. c.* (ii, p. 64), which, as the author says, is often marked upon the leaves of species of Ficus, rendering their surface rough, and covering the areolation. This kind of verrucose process is quite distinct under the glass. The bows of the secondaries along the borders are also typical of species of Ficus as well as the broad petiole.

Two specimens; Museum number, 2478.

10.

Lassen County, Cal. Collected by Mr. J. S. Diller. Age, Eocene (Laramie).

Aralia lasseniana, n. sp. Plate XIV, fig. 5.

Leaflet linear, oblong, rounded at base to a short petiole, entire or undulate on the borders, subcoriaceous, penninerved; secondaries distant and equidistant, parallel, opposite, at a broad angle of divergence, strongly marked like all the details of nervation, camptodrome, nerving in passing toward the borders and following them, by anastomosing by curves and nervilles, to the upper one; nervilles strong, at right angles to the medial nerve and to the secondaries, irregularly branching and anastomosing, forming large polygonal meshes.

The leaflet, broken at apex, is 8^{cm} long, $1\frac{1}{2}$ to 2^{cm} broad near the base, 3^{cm} broad at the upper part where it is broken.

As yet I have seen nothing in the North American fossil flora to which this leaf might be related. It is comparable in all its characters, form, and nervation, to *Aralia robusta* (Sap. Sez. Fl., p. 386, Pl. x, fig. 7). It has also the aspect of leaves of Laurus, *e. g.*, *L. Reussii*, *L. primigenia* var., but is quite distinct by its distant parallel secondaries. The leaflet, not entirely preserved, seems to be part of a compound leaf.

One specimen; Museum number, 2425.

Magnolia Inglefieldi Heer.

The description of the species in Heer (Fl. Arct., 1, p. 120) is as follows: "M. leaves large, coriaceous, smooth (*levigati*), very entire, ellip-

tical; medial nerve thick; secondaries distant, flexuous, camptodrome, areas large reticulate."

It seems against reason to separate these fragments, which are large and numerous, and to form a new species. They agree well for the essential characters, the large size of the leaves, the thick medial nerve, the distant secondaries, the areas reticulate as in 876 and 876*a*, but they differ by the secondaries being stronger at a still more acute angle of divergence, less branched, following upward close to the borders, and the very thick nervilles. The base of the leaves is narrowed gradually (as in the fig. 1 of the Fl. Arct., Pl. XVIII), and the medial nerve is quite thick. It is evidently a variety of the species which, as represented by Heer, is extremely variable. One specimen, No. 877*a*, shows the leaf rounded to a point; the apex is not seen in any of Heer's leaves.

Twelve specimens; Museum number, 2511.

Magnolia Hilgardiana Lx.

The leaf finely preserved has the form and the nervation of the species so that identity appears undeniable. It differs somewhat, nevertheless, by the secondaries somewhat more curved in traversing the areas, and at a somewhat more acute angle of divergence. This, however, is of no importance, as the American specimen has, like that of Mississippi, the secondaries a little more oblique on one side than on the other. The more important difference is in the lower secondaries, which in the Mississippi leaves are more open toward the base, and this does not appear to be the case in No. 879, of which, however, the base is destroyed.

Two specimens; Museum number, 2510.

Magnolia californica Lx.

There are five fragments of this species differing slightly from the figures I have given of the species in Gold-bearing Gravels, pl. vi, fig. 7. The characters are, however, well preserved in the much curved parallel secondaries, curving near the borders, and following them in simple areoles. The secondaries are simple; the nervilles very strong, also simple, straight, or undulate.

Five specimens; Museum number, 2508.

Laurus socialis Lx.

Three specimens; Museum number, 2500.

Cinnamomum! Scheuchzeri Heer.

One specimen; Museum number, 2450.

Cornus hyperborea Heer. Plate XV, fig 3. (Heer, Fl. Foss. Arct., vol. ii, pt. iv, p. 476, Pl. IV, figs. 3, 4.)

The description of Heer does not accord with the figures of his species *loc. cit.* He says: "Leaves elliptical, with few nerves; secondaries emerging at an acute angle of divergence, acrodrome, distant." From

the two fragments figured, the nerves are not few nor distant, but close, parallel, numerous, simple, acrodrome, the upper ones nearly parallel to the medial nerve, which is comparatively narrow.

The leaf which I refer to the species, a fragment 14^{cm} long, the base and the apex destroyed, has eight pairs of secondaries subopposite, the lowest less than 1^{cm} distant, the upper ones $2\frac{1}{2}^{cm}$ at an angle of divergence of 40 to 45 degrees, same as marked in Heer's figures. This one is marked by transverse, simple, strong nervilles, which are not seen in the American specimens whose surface is quite smooth. This species is of the same type as *Cornus Kelloggii* (Lesqx., Fl. of the Aurif. Gravel, p. 23, Pl. VI, fig 3,) which merely differs by the leaf broader (nearly round) the secondaries more distant, only four pairs, opposite, also simple, acrodrome. The specimen figured by Heer is from Atanekerdluck.

One specimen; Museum number, 2454.

Leguminosites, spec.

One specimen; Museum number, 2637.

Oreodaphne lithæformis, n. sp. Plate XIV, fig 4.

Leaf coriaceous, oblong-lanceolate, gradually narrowing and prolonged upward; borders entire; medial nerve rigid; secondaries thin, the lowest pair subopposite, the others few, alternate, distant, all at an acute angle of divergence, slightly curving in passing high up toward the borders, camptodrome, areolation in minute round areoles.

The leaf, only partly preserved, is $12\frac{1}{2}^{cm}$ broad, the upper part being destroyed, 5^{cm} broad above the base, narrowed in gradually rounding to a short petiole; secondaries, five pairs, the lowest and the upper only opposite, unequidistant, 2 to $2\frac{1}{2}^{cm}$ distant, but parallel, at an angle of divergence of 25 to 30 degrees. They run very high in gradually nearing the borders and disappear before reaching them.

The aspect of this leaf is much like that of species of *Persea*, especially *P. caroliniana*, var. *assimilis*, Sap. & Mar., in Fl. de Meximieux. But its characters, taken altogether, relate it to Oreodaphne, especially the areolation and the presence of a kind of tumescence in the axils of some of the secondaries. Its nervation is that of a *Litsæa*. Its nearest affinity is *Oreodaphne Heerii* Gaud., as figured in Sism. Mater., Pl. XXII, fig. 1, a leaf of which all the secondaries, even the lowest, are alternate at a very acute angle of divergence and running high up to the borders. The form of the leaf is different, as it is rather linear from above the base to the point where it is broken. By this form and the distant secondaries irregularly placed, it is most like *Litsæa expansa* Sap. & Mar. (Fl. de Gelinden, p. 68, Pl. XI, figs. 1, 2).

One specimen; Museum number, 2525.

Oreodaphne Heerii Gaud.

This is perhaps the same as the preceding species, showing only a fragment, the middle of a leaf with the pairs of opposite secondaries

very distant and at the same degree of divergence as in the preceding species.

Quercus Moorii Lx.

Four specimens; Museum number, 2561.

Quercus Olafseni Heer.

One specimen; Museum number, 2560.

Juglans rugosa Lx.

One specimen; Museum number, 2491.

Ficus appendiculata Heer.

One specimen; Museum number, 2470.

Phragmites oeningensis Al. Br.

Four specimens; Museum number, 2531.

11.

From Cape Lisbourne, Alaska. Collected by Mr. Henry D. Woolfe. Age probably Neocomian.

Ginkgo multinervis Heer. Plate XVI, fig. 6. (Heer, Fl. Arct., VI, (2) p. 46, Pl. VIII, figs. 2*b*, 3, 4; Pl. IX, f. 3*b*.)

Heer describes the species as leaves palmate, deeply lobate, narrowed toward the base, cuneate truncate at apex; nerves thin, numerous, very close. The specimens from Alaska agree entirely with the description and figures of Heer, *l. c.*, except that he says of the lobes, that they are truncate at apex. They are truncate by erosion or breakage, but really obtuse as Heer has figured them, Pl. IX, figs. 3, 6. The Alaska specimen is only better preserved.

One specimen; Museum number, 2482.

Baiera palmata Heer. Plate XVI, figs. 4, 5. (Heer in Fl. Ost. Siberia, p. 115, Pl. XXVIII, figs. 2–a–d.)

The specimens from Alaska represent only the lower part of the leaves, which are entire to the middle or above, and there digitate, laciniate, the division of the laciniæ being merely seen in a sinus at a distance of 9^{cm} from the base. In Heer's specimens it is mostly the upper part or the laciniæ which are preserved. A fragment of one of the laciniæ is 9^{cm} long, $1\frac{1}{2}^{cm}$ broad, broken at both ends. The characters are as described by Heer.

Five specimens; Museum number, 2437.

Podozamites latipennis Heer. Plate XVI, figs. 2, 3.

The species is represented in many figures by Heer (Fl. Arct., VI, (2) Pl. XIV, figs. 1–9). It is described (p. 42) as leaves (pinnæ) large; leaflets open, alternate, a little distant, long-lanceolate, 11 to 16^{mm} broad, narrowed to the base, gradually narrowed to the apex; nerves thin, close parallel.

There is no leaflet attached to rachis in the specimens from Alaska, only separate ones, the largest 11^{cm} long, 2^{cm} broad; some much shorter and narrower with the nerves thick, 16^{cm} in width, or as many as marked in Heer's figure. The base of the large leaflet is more narrowed and rounded, the oblique point of attachment being only 5 to 8^{mm} while it is 1^{cm} in Heer's figure.

Three specimens; Museum number, 2540.

Zamites alaskana, n. sp. Plate x, fig. 4.

Fragment of a leaflet, obcordate or emarginate at the point of attachment, slightly enlarging upward to the middle where it is destroyed, and there 22^{mm} broad at 4^{cm} distance from the base. At the point of attachment, 5^{mm} broad only and semilunar, it is marked with three slightly distinct undulations. The nerves are very thin, parallel, a little less than 1^{mm} distant or six in 5^{mm} of width. Its affinities are distantly marked with Jurassic species. (*Zamites distractus* Sap., Jurassic Fl.; *Z. Benevieri* Heer, Fl. Foss. Helv., iv, Pl. LII.)

One specimen; Museum number, 2622.

Pecopteris denticulata Heer.

One specimen; Museum number, 2526.

Aspidium Oerstedi Heer.

Arct. Fl., vi, p. 30, Pl. XXXIV, fig. 3, is represented by many specimens, some with large pinnæ and pinnules near the base of the fronds, others with narrow long strict pinnæ and pinnules similar to those of the upper part of the fronds.

Fourteen specimens; Museum number, 2434.

Asplenium Dicksonianum Heer.

One specimen; Museum number, 2435.

Asplenium Foersteri Deb. & Ett.

One specimen; Museum number, 2536.

Pinus! staratschini Heer.

One specimen; Museum number, 2533.

Chondrites filiciformis, n. sp. Plate XVI, fig. 1.

Frond cartilagineous or coriaceous by compression, shining on the surface; primary branches straight, linear; secondary divisions sparse, diverging nearly at right angles, subpinnately ramose in oblique or horizontal, short obtusely trilobate or long flexuous branchlets bearing irregular round or obtuse squamose lobes at their base or at their extremities.

The stone has some fragments of primary linear branches, one of them only bearing divisions, the first at right angles, nearly as thick as the primary stem with oblique or nearly horizontal subdivisions either short obscurely trilobate, or longer once lobate at base and bitrilobate at apex.

This species has a great likeness to *C. jugiformis* Hosius & Mark, Kreideform. of Westfal, Pl. XXVI, fig. 16, also in Deb. & Ett., Kreide Fl. von Aach., Pl. I, figs. 8, 9, or to Jurassic species. *C. Dumortieri* Heer, Fl. Foss. Helv., iv, Pl. XLIII, fig. 16, also related to *Caulerpites*. It may be a form of *C. jugiformis* Hosius.

One specimen; Museum number, 2448.

12.

Specimens from Greenland. Collected by Lieut. R. E. Peary, U. S. Navy; age, Miocene.

Rhamnus eridani Ung.

One specimen; Museum number, 2576.

Cornus ferox Ung.

One specimen; Museum number, 2453.

Ilex longifolia Heer.

One specimen; Museum number, 2485.

Magnolia Inglefieldi Heer.

Six specimens; Museum number, 2512.

Magnolia regalis Heer.

One specimen; Museum number, 2518.

Daphnogene Kanii Heer.

Two specimens; Museum number, 2460.

Tilia Malmgreni Heer.

One specimen; Museum number, 2619.

McClintockia Lyellii Heer.

Eight specimens; Museum number, 2519.

McClintockia dentata. ?

One specimen; Museum number, 2520.

Populus arctica Heer.

Twelve specimens; Museum number, 2543.

Populus Richardsoni Heer.

Three specimens; Museum number, 2548.

Populus monodon Lx.

Five specimens; Museum number, 2447.

Salix grœnlandica Heer.

One specimen; Museum number, 2590.

Corylus insignis Heer.

One specimen; Museum number, 2456.

Corylus Mcquarryi Heer.

Sixteen specimens; Museum number, 2457.

Nov. 8, 1888.

Quercus ? grœnlandica ? Heer.

Specimen discarded.

Quercus Laharpii Gaud.

Two specimens; Museum number, 2557.

Quercus Olafseni Heer.

Two specimens; Museum number, 2558.

Quercus platania Heer.

One specimen; Museum number, 2564.

Juglans acuminata Al. Br.

Two specimens; Museum number, 2486.

Juglans rugosa Lx.

Two specimens; Museum number, 2492.

Platanus Guillelmae Jöpp.

One specimen; Museum number, 2537.

Zizyphus Meekii Lx.

One specimen; Museum number, 2623.

Sequoia brevifolia ? Heer.

One specimen; Museum number, 2611.

Sequoia Langsdorfii Heer.

Thirty-two specimens; Museum number, 2606.

Sequoia Langsdorfii var **acuta.**

Eleven specimens; Museum number, 2608.

Sequoia Langsdorfii var. **angustifolia.**

Twelve specimens; Museum number, 2609.

Glyptostrobus Ungeri Heer.

One specimen; Museum number, 2480.

Taxodium distichum miocenum Heer.

Eleven specimens; Museum number, 2615.

Taxodium distichum miocenum, var. **angustifolium,** Heer.

Two specimens; Museum number, 2616.

Taxodium Tinajorum Heer.

Four specimens; Museum number, 2617.

Taxites Obriki Heer.

Eight specimens; Museum number, 2618.

Fagus Deucalionis Ung.

A number of small or medium sized, entire leaves, ovate, acuminate, rounded at base, with craspedodrome close parallel secondaries somewhat curved in traversing the blade and strong parallel generally simple nervilles at right angles to the secondaries. The only relation of these leaves is with those of the Arctic flora, which Heer considers and de-

scribes as *Fagus deucalionis.* They differ by the coriaceous texture, the secondaries more or less curved in traversing the blade, rigid, forming narrow rectangles; the borders entire, even in the upper part, and the acuminate apex longer and narrower than in Pl. IV, fig. 3, Nachtrage zum foss. fl. of Grœnland Fl. Arct., v. The affinity is so marked that I do not separate these leaves into a new species, but the differences are, however, evident. The rectangles formed by the nervilles are recognized even in numerous small fragments of these leaves.

13.

From Contra Costa County, Cal. Collected by Mr. H. W. Turner. Age, probably Pliocene.

Diospyros virginiana L., var. **Turneri**, n. var.

The leaves have the same form and size as those of *D. virginiana* Linn., and appear to represent the same species, differing merely by the lowest pair of secondaries at a more acute angle of divergence than those above. In *D. virginiana* the same character is also sometimes observable, but rarely indeed, and the difference in the direction of the lower secondaries is much less marked. There is no species of *Diospyros* in the present flora of California. A number of species, however, are now in the flora of Japan. These fossil leaves described here have also a degree of affinity to *D. lotus*, var. *japonica* (*D. Japonica* S. et Z.), but the basilar secondaries of the last species are parallel to those above it.

Three specimens; Museum number, 2461.

Magnolia californica Lx.

One specimen; Museum number, 2509.

Laurus, *cf.* **canariensis** Heer.

Laurus, *cf.* **Furstenbergi** Heer.

Fragments discarded.

Viburnum, *cf.* **rugosus** Pers.

One specimen; Museum number, 2625.

Vitis, species?

One specimen; Museum number, 2626.

14.

Sam's Creek, Jackson County, Oregon. Mr. B. F. Dowele, collector.

Salix Lavateri Al. Br.

One specimen; Museum number, 2592.

Sapindus angustifolius Lx.

Two specimens; Museum number, 2600. Several indeterminable fragments.

15.

Specimens donated by Mr. J. B. Marcou, of the U. S. Geological Survey. Locality in doubt, but marked "Fossil Point, P. Y. Sheet."

Cratægus Marcouiana, n. sp. Plate XIV, fig. 2, XV, figs. 1, 2.

Leaves rather thin, elliptical, acuminate, entire or dentate from the middle upward; attenuate at base; medial nerve somewhat strong; secondaries few, distant, three to five pairs, oblique, angle of divergence 30 degrees, subopposite, parallel, the lower suprabasilar nervilles at right angles to the secondaries.

The three leaves figured appear at first as referable to two different species, but some intermediate fragments show their identity, as well as the form and the nervation. The leaves are comparable to those of *Cratægus Kornerupi* Heer (Arct. Fl., vii, 2, p. 136, Pl. LXVII, fig. 1) and *C. tenuipes* Heer (*ibid.*, Pl. LXXXIII, fig. 8), as well as to those of some living species like *C. arborescens*, *C. mexicana*, *C. crusgalli*, etc. The leaves vary from 5 to 8^{cm} long and from $2\frac{1}{2}$ to 4^{cm} broad, with a slender petiole $1\frac{1}{2}^{cm}$ long, enlarged at the point of attachment.

Seven specimens; Museum number, 2458.

Cratægus Marcouiana, n. sp., var. **subintegrifolia**, n. var. Plate XIV, fig. 2.

Two specimens; Museum number, 2459. Several fragments; worthless.

16.

Selma, Cherokee County, Tex. Collected by Mr. L. Johnson, of the U. S. Geological Survey.

Quercus furcinervis Rossm.

One specimen; Museum number, 2553.

Persea speciosa ? Heer.

One specimen; Museum number, 2629.

Laurus primigenia Ung.

Two specimens; Museum number, 2499.

Eucalyptus, Quercus, Laurus, etc.

Fragments.

17.

From Bridgetown, N. J. Collected by Mr. J. B. Marcou, of the U. S. Geological Survey. Specimens very obscure; mostly undeterminable.

Liquidambar europæum Al. Br.

One specimen; Museum number, 2639.

Laurus primigenia ? Heer.

Five specimens; Museum number, 2640.

Laurus plutonia ? Heer.

Four specimens; Museum number, 2644.

Populus Berggreni ? Heer.

Two specimens; Museum number, 2641.

Proteoides acuta Heer.

One specimen; Museum number, 2642.

Leguminosites phaseolites ? Heer.

Two specimens; Museum number, 2643.

18.

Plants collected by Captain (since General) J. C. Frémont during the geographical survey of Oregon and north California in 1843–'44. Described by James Hall in Frémont's "Exploring Expedition to the Rocky Mountains." (Doc. No. 166, Washington, 1845, pp. 304–307, Pls. I–III.)

[The numbers given the specimens are the preliminary ones used by Professor Lesquereux during his examination. The regular Museum numbers are included in brackets.]

1, 1a. [2645.] *Glossopteris phillipsii?* Hall. Plate II, figs. 5, *5a*, *5b*, *5c*.

This is remarkably similar in form of leaves and nervation to *Glossochlamys transmutans* Gard. & Ett. (Brit. Eoc. Fl., Pl. III, fig. 3; XII, fig. 8). The specimens of Frémont show indistinctly nervilles between the lateral nerves composing irregular, square meshes. In fig. 8, Pl. XII, of Gard & Ett., the leaf has the areolation obsolete and the lateral nerves split, not branching near the end as in the figure of Hall.

No. 2. [2646.]

Represents two leaves of the same size and character with the secondaries slightly defined or scarcely so, and the areolation a little more distinct in one of them.

No. 3. [2647.]

Has three fragments of leaves *a*, *b*, *c*; *a* is like a dicotyledonous plant in appearance, but the areolation is formed of branches at right angles to the secondaries, which look like nervilles, but are really divisions of the nerves as they are enlarged at their point of attachment. The same character is seen in *b*, and in this as in *c*, the ultimate areoles are pitted as in Hall's fig. *5c* of Pl. II, the same areolation is seen in the leaves of *Dictyophyllum nilsoni* (Nath. Wäxte from Falszö, Pl. V, fig. 2).

No. 4, 4a. [2648.]

A large specimen with one large leaf, size and form of *Glossochlamys transmutans*, *l. c.*, with the areolation of a *Chrysodium*. The left side of the lamina is traversed by a single, curved secondary (?) nerve, which, however, does not appear as a nerve, as the meshes of the epidermis covers it interruptedly and independently of it. The other leaf, a fragment only, looks, at first sight, like a *Ficus* by its nervation. But here also the relation of the areoles to the secondaries and tertiaries is not like a subdivision by degrees of larger areas into smaller ones, but a chain or linking of branches constituting still a netting of irregularly round oblong areoles of the same type as in *Podoloma polypodioides* (Ett. & Gard, *l. c.*, Pl. III, fig. 9).

No. 5. [2649.]

Is in two fragments of a different leaf (figured, pl. ii, fig. 5*k*, of Hall). It has the pitted areolation like *Dictyophyllum* mentioned above.

No. 6. [2650.]

A small fragment of *Dictyophyllum* or *Clathropteris*. It has no secondaries, but only large square areoles like *Clathropteris*.

The specimen representing fig. 4, of Pl. II, of Hall, is part of an ovate leaf, lanceolate pointed above and dentate on the borders, the secondaries entering the teeth. The figure is really that of a dicotyledonous leaf, but the specimen is not in the lot!

What seems to me to be conclusive of the Oölithic age of the plants is the number of fragments of small ferns referable to the genus *Thrysopteris*, of which Heer has described a number of species from the Jurassic in Jura Flora of Siberia, Pls. I, II; also in Portugal flora, and which are also described as *Hymenophyllites lechenbyi* in Zigno, Pl. IX, figs. 3–5, and Pl. XI, figs. 1, 2. Plate I, fig. 4, of Hall, is like *Cycadopteris heterophylla* Zigno, and fig. 3 of Pl. II is like *C. heerii* Zigno. Those small ferns mixed upon small specimens are really Oölithic type.

No. 7. [2651.] *Sphenopteris trifoliata* Hall. Plate II, figs. 2, 2*d*. It is a *Thyrsopteris*.

No. 8. [2652.] *Thrysopteris*, with rootlets of ferns, named by Hall *Trichopteris gracilis*. Plate I, fig. 5.

No. 9. [2653.] Fragment of *Thrysopteris*, named by Hall *Sphenopteris triloba*. Plate I, fig. 8.

Nos. 10, 11. [2654.] *Pecopteris undulata* Hall. They are not *Pecopteris*: nervation obsolete.

No. 12. [2655.] *Glossopteris phillipsii* Hall.

No. 13. Fragment; rachis of fern.

No. 14. Fragment; probably like 4*a*.

19.

"Fortieth parallel collection." Collector not known.

Acu trilobatum Sternb.

Eight specimens; Museum number, 2416.

20.

Miscellaneous localities.

Ilex longifolia Heer. Cascades, Oregon. A. Haque, collector.

One specimen; Museum number, 2484.

Cinnamonium affine Lx. Carbon Station, Wyoming. A. Haque, collector.

One specimen; Museum number, 2449.

Cissus lobato-crenato? Lx. Carbon Station, Wyoming. A. Haque, collector.

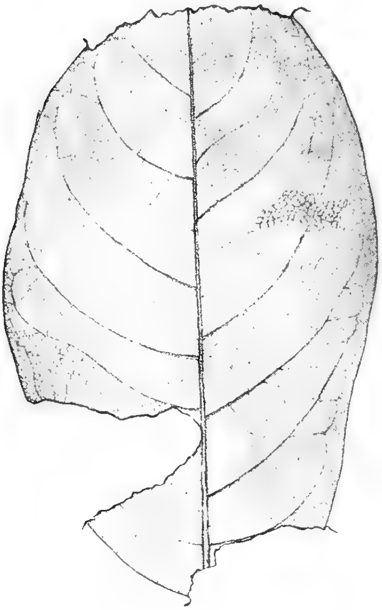
One specimen; Museum number, 2451.

Salix Grœnlandica Heer. Carbon Station, Wyoming. A. Haque, collector.

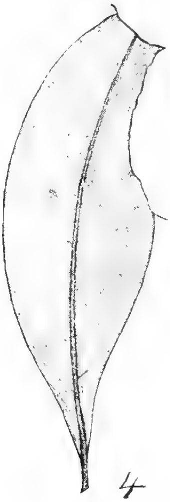
One specimen; Museum number, 2591.

Sequoia Reichenbachi Heer. Rock Creek, Wyoming. Collector unknown.

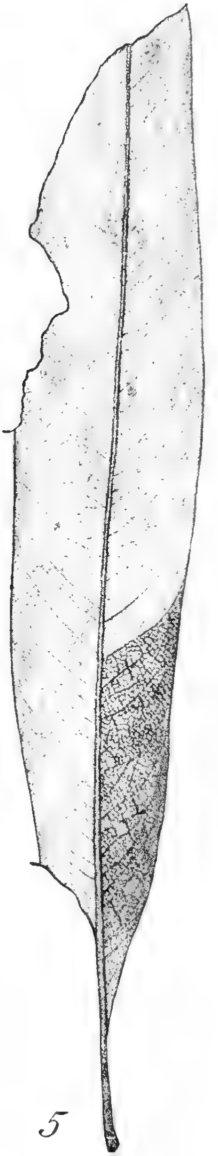
PLATE IV.



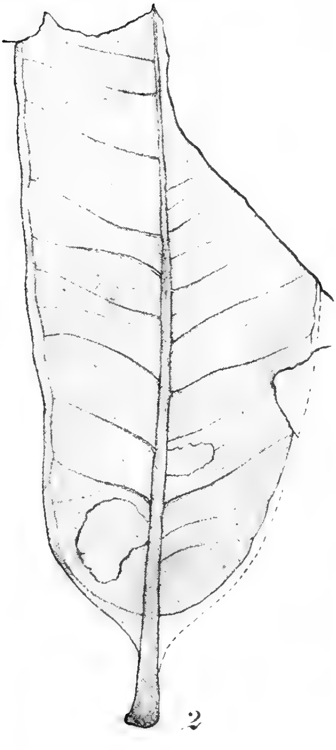
1



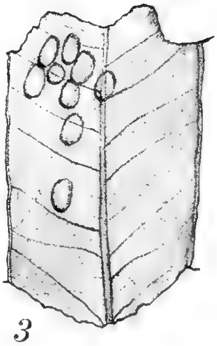
4



5

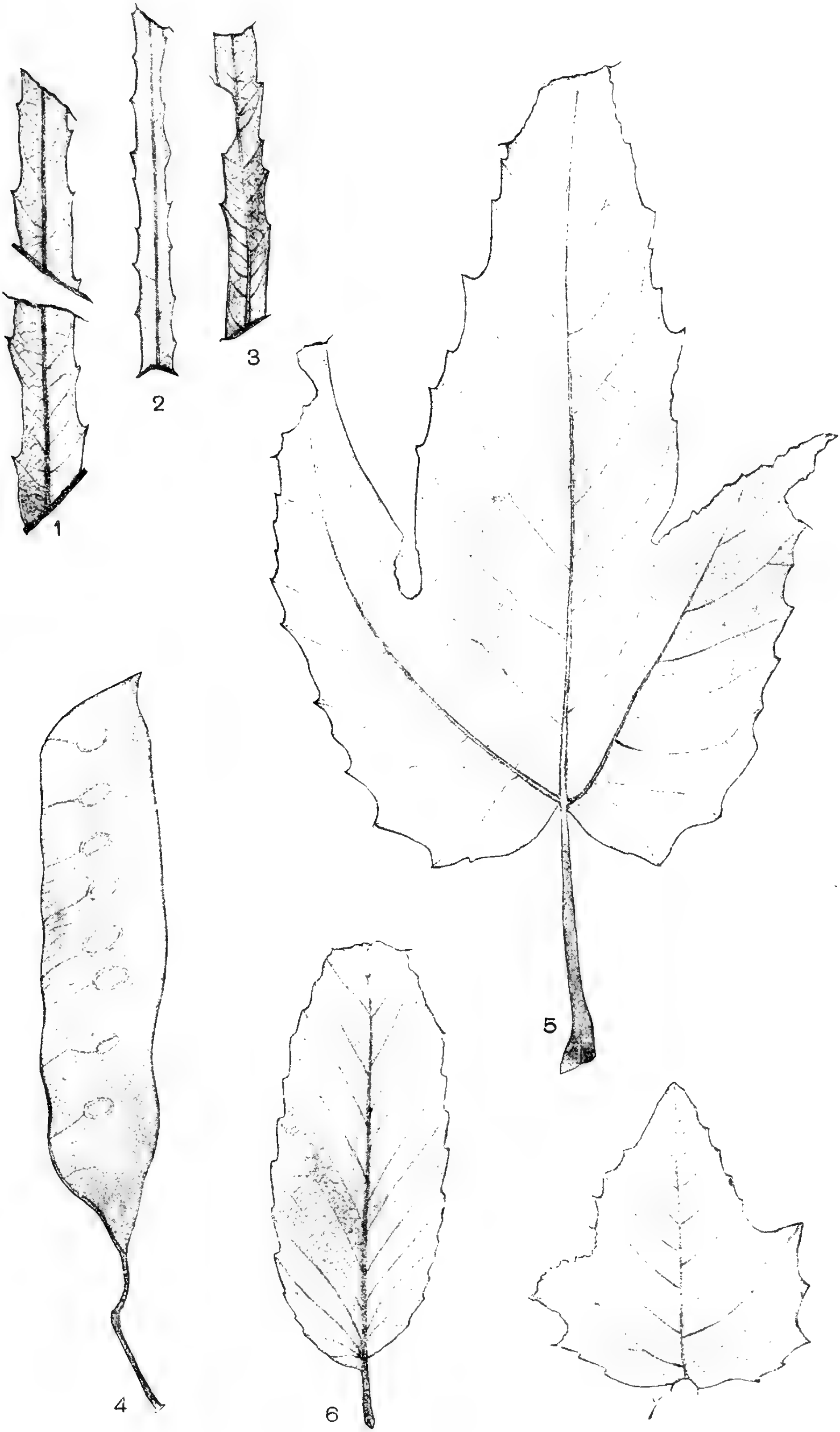


2



3

FIG. 1. *Laurus Californica* Lx. (Page 12.)
FIGS. 2, 3. *Ficus multinervis* Heer. (Page 11.)
FIG. 4. *Sapindus falcifolius* Heer. (Page 12.)
FIG. 5. *Myrica elænoides*, n. sp. (Page 12.)



FIGS. 1-3. *Quercus Saffordii* Lx. (Page 13.)
FIG. 4. *Acacia Oregoniana*, n. sp. (Page 14.
FIG. 5. *Acer Bendirei*, n. sp. (Page 14.)
FIG. 6. *Quercus Horniana*, n. sp. (Page 17.)
FIG. 7. *Platanus aceroides* Al. Br. (Page 19.)

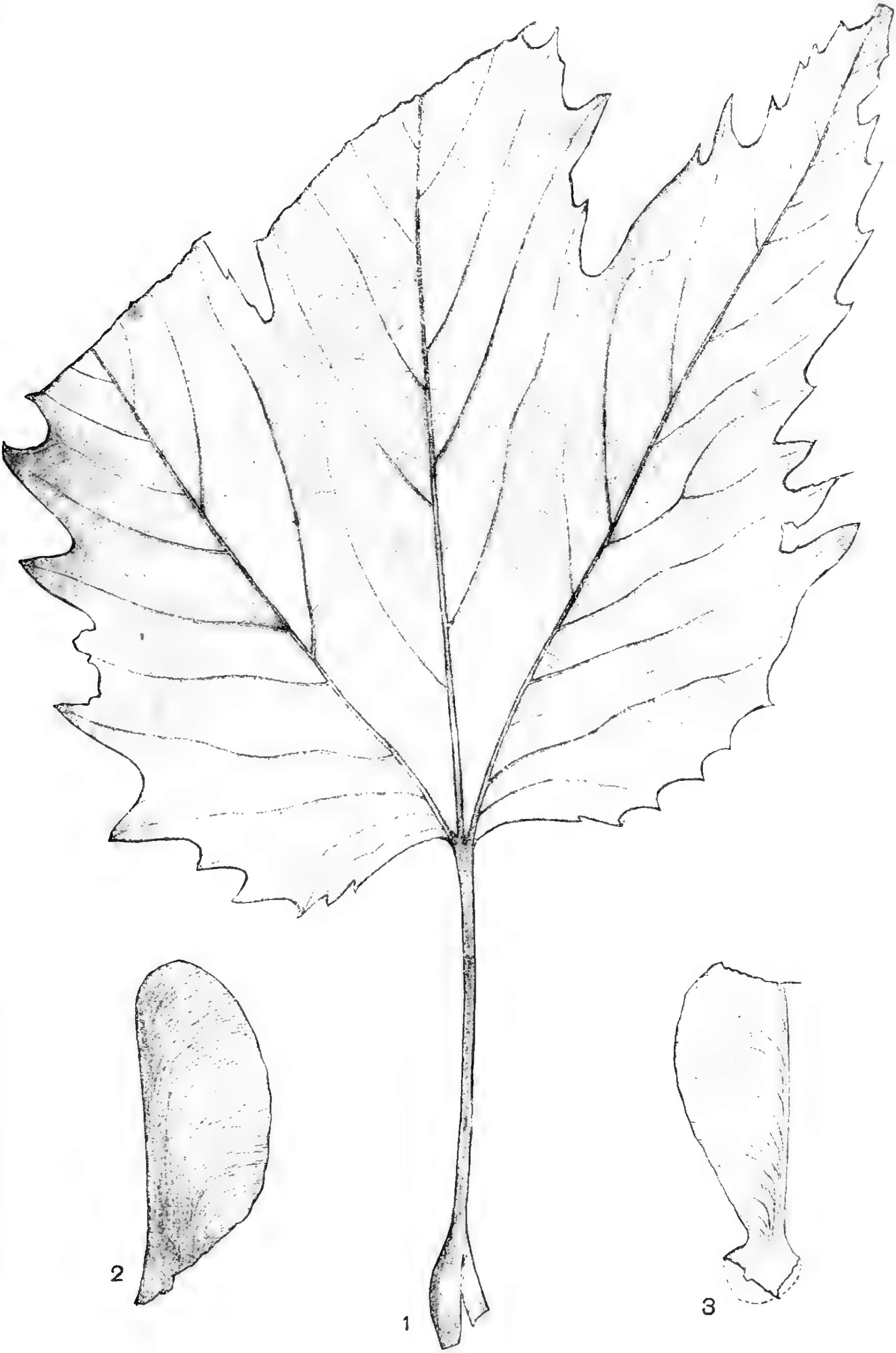


FIG. 1. *Acer Bendirei*, n. sp. (Page 14.)

FIGS. 2, 3. *Acer*, fruits of. (Page 15.)

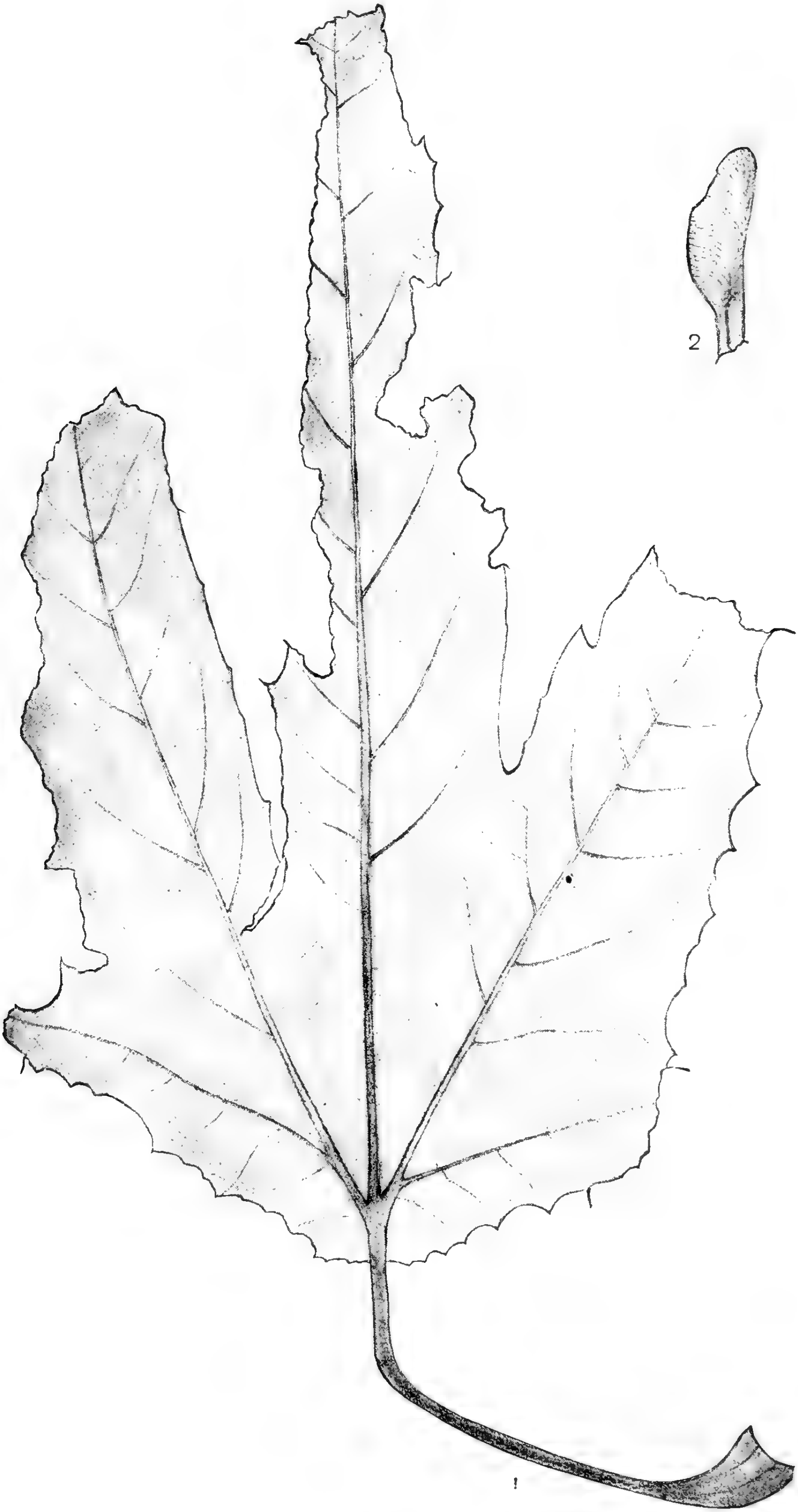
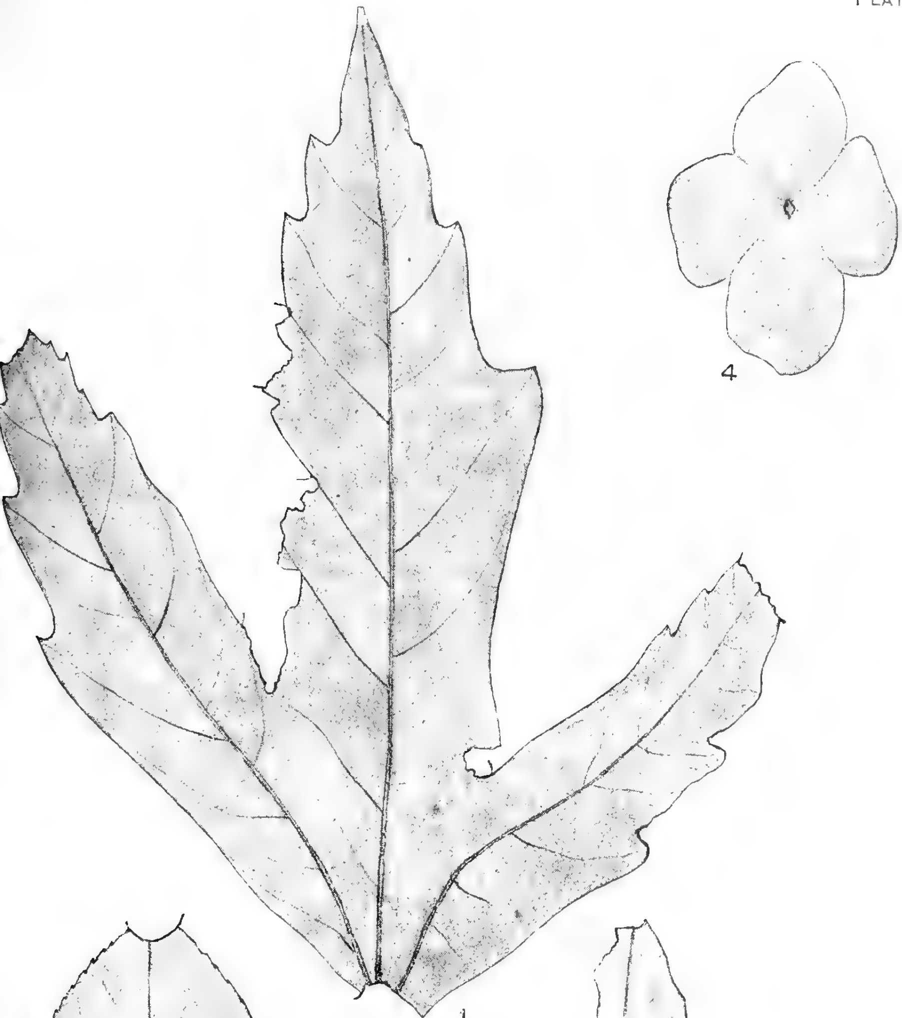
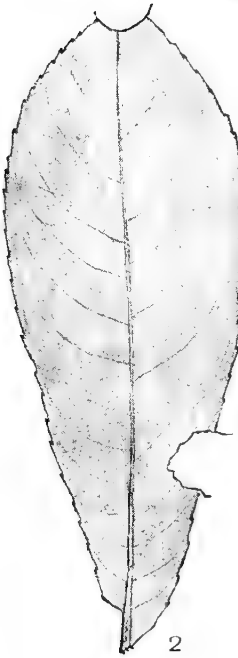


FIG. 1. *Acer Bendirei*, n. sp. (Page 14.) FIG. 2. *Acer*, fruit of. (Page 15.)

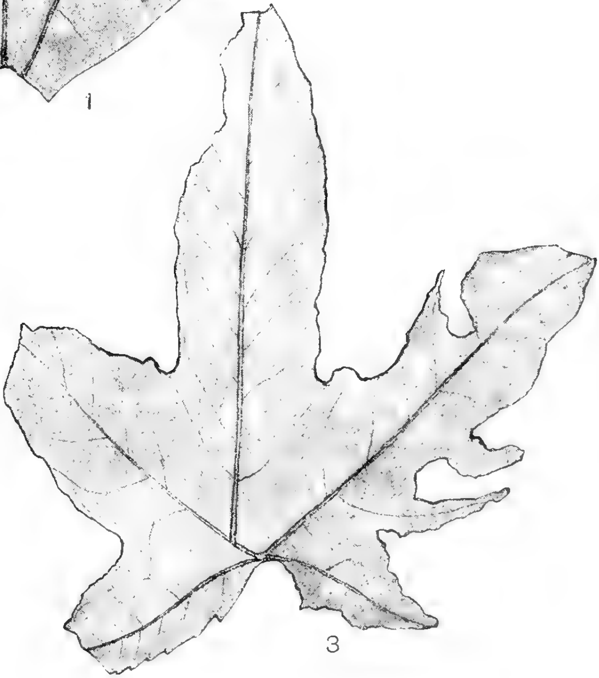


1

4



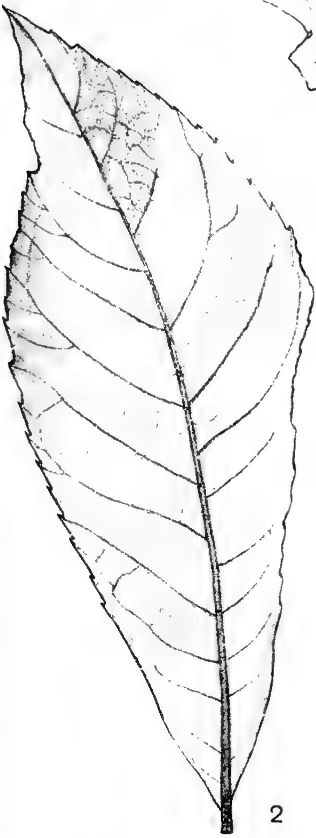
2



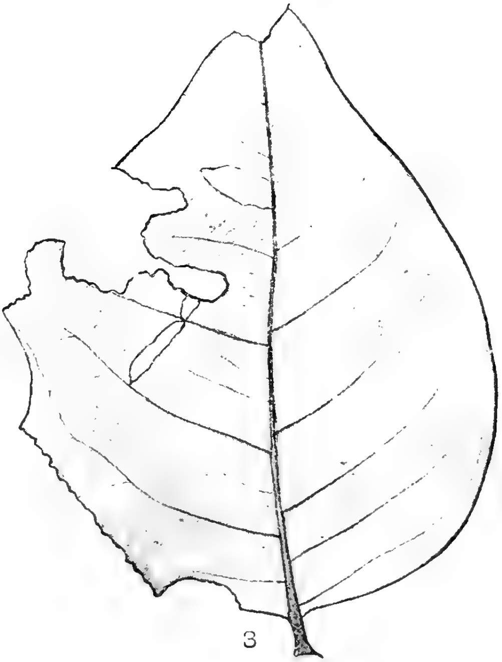
3

FIG. 1. *Acer Bendirei*, n. sp. (Page 14.)
FIG. 2. *Salix Engelhardti*, n. sp. (Page 17.)
FIG. 3. *Liquidambar protensum* Ung. (Page 13.)
FIG. 4. *Porana Bendirei* Lx. (Page 16.)

1



2



3

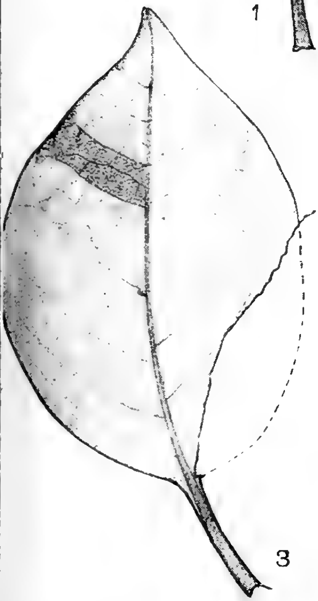
FIG. 1. *Acer dimorphum*, n. sp. (Page 15.)
FIG. 2. *Rhus Bendirei*, n. sp. (Page 15.)

FIG. 3. *Ficus ? Oregoniana*, n. sp. (Page 18.)

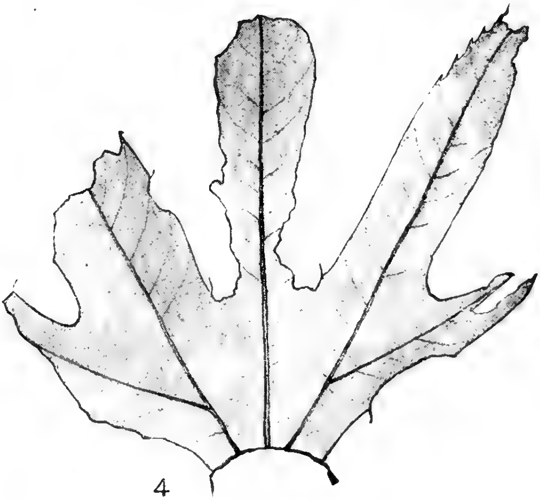
FIG. 1. *Quercus pseudolyrata* Lx. (Page 17.)
FIG. 2. *Quercus pseudolyrata* Lx., var. *brevifolia*. (Page 18.)
FIG. 3. *Quercus pseudolyrata* Lx., var. *obtusiloba*. (Page 18.)
FIG. 4. *Zamites Alaskana*, n. sp. (Page 32.)

1

2



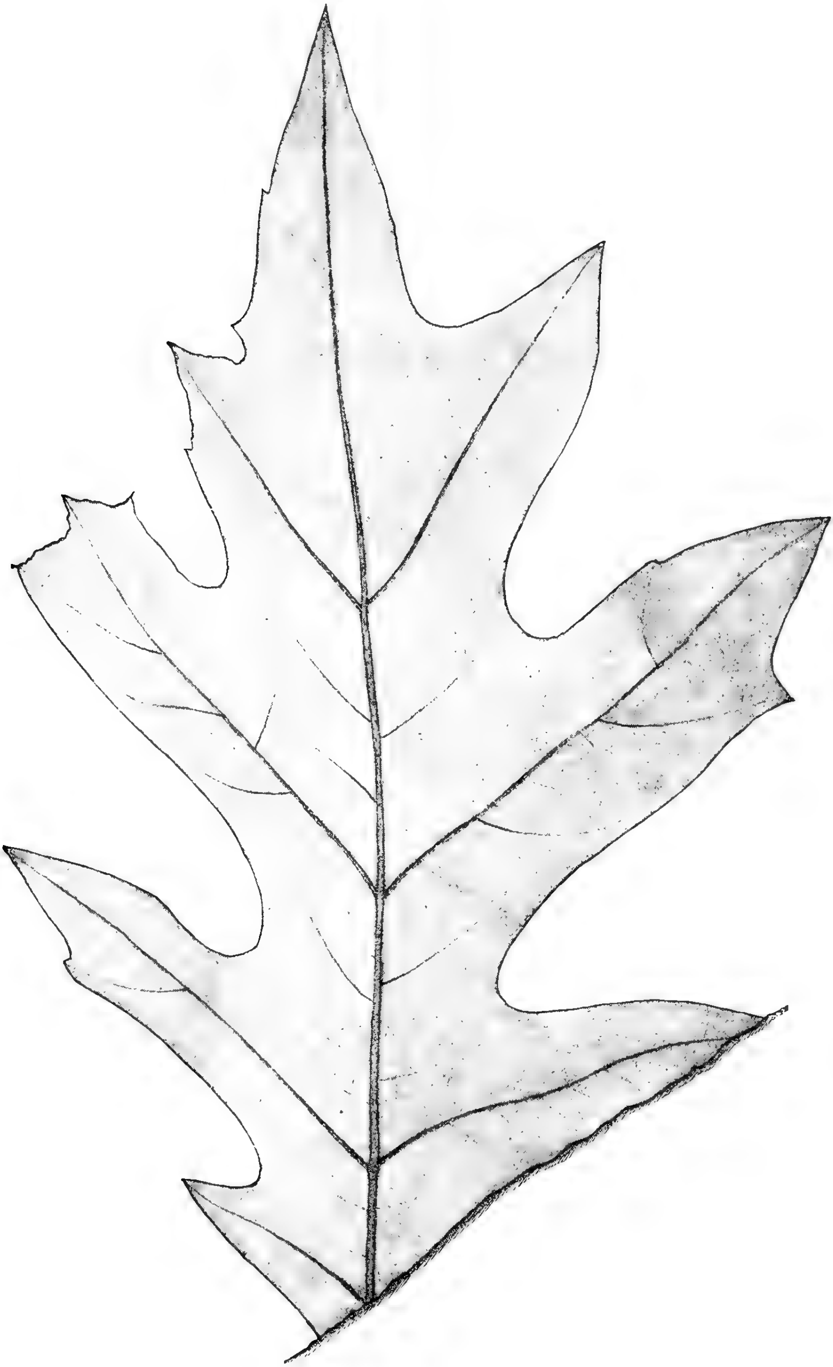
3



4

1. *Quercus pseudolyrata* Lx., var. *acutiloba*. (Page 17.)
2. *Quercus pseudolyrata* Lx., var. *angustiloba*. (Page 17.)

Fig. 3. *Ficus Shastensis*, n. sp. (Page 28.)
Fig. 4. *Aralia digitata* Ward. (Page 20.)



Quercus pseudolyrata Lx., var. *latifolia*. (Page 18.)

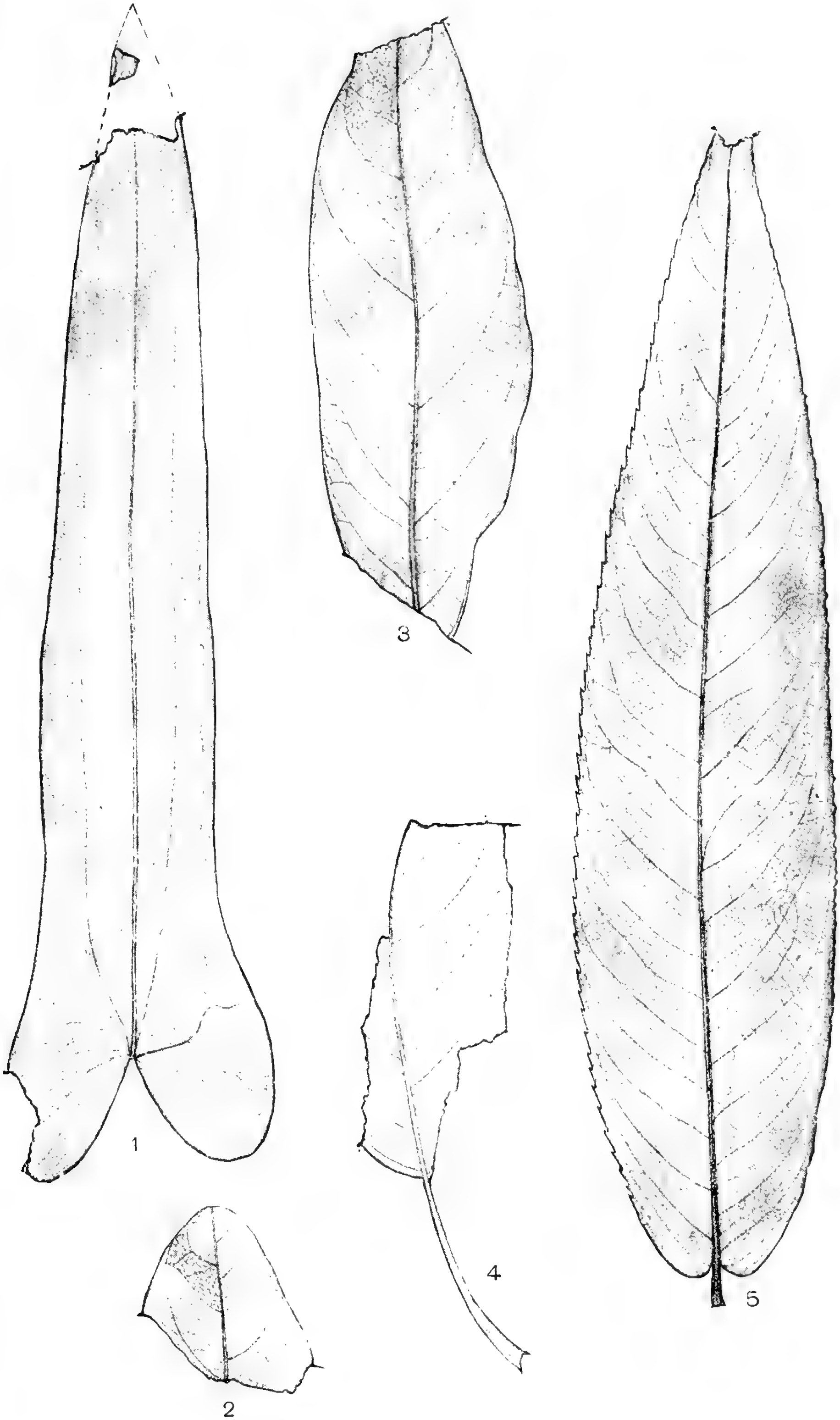


FIG. 1. *Smilax Wardii*, n. sp. (Page 19.)
FIGS. 2-4. *Persea Dilleri*, n. sp. (Page 27.)
FIG. 5. *Salix Shimperi*, n. sp. (Page 21.)

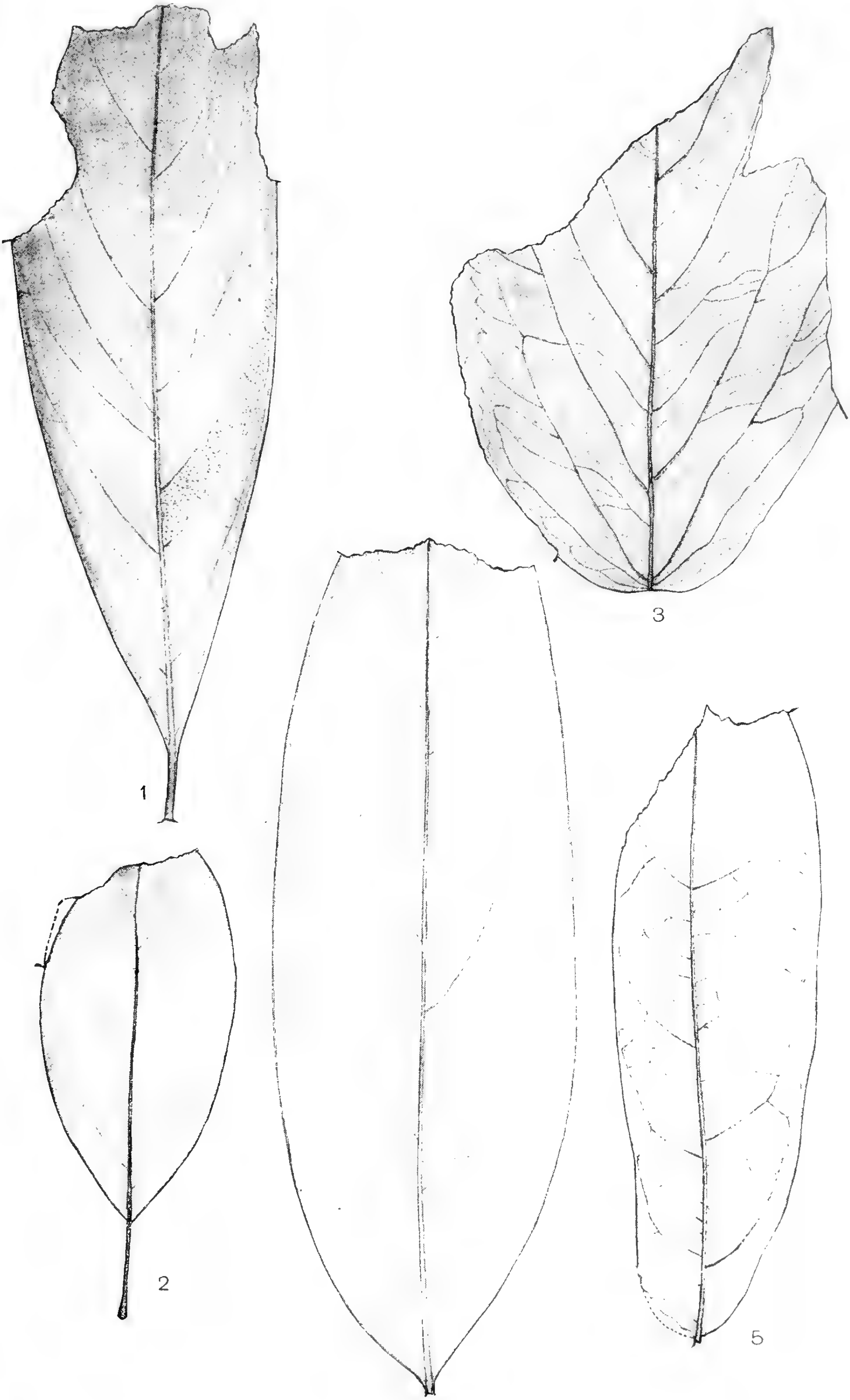
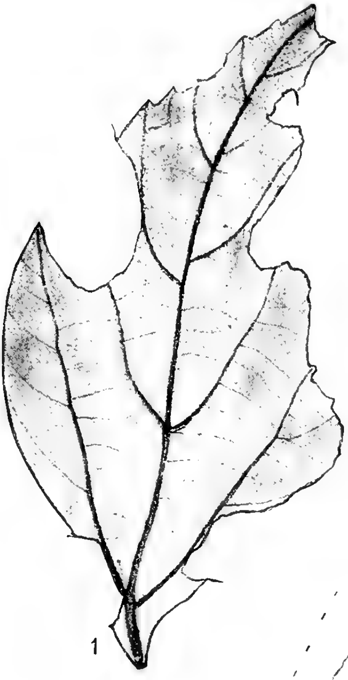


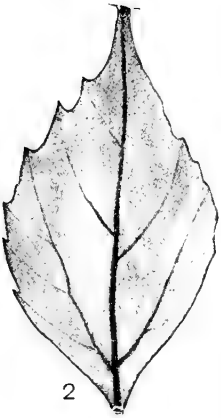
FIG. 1. *Persea punctulata*, n. sp. (Page 26.)
FIG. 2. *Cratægus Marcouana*, n. sp. (Page 36.)
FIG. 3. *Phyllites Wascoensis*, n. sp. (Page 22.)
FIG. 4. *Oreodaphne litsæformis*, n. sp. (Page 30.)
FIG. 5. *Aralia Lasseniana*, n. sp. (Page 28.)

PLATE XV.



1

3



2

FIG. 1 *Cratægus Marconana*, n. sp. (Page 36.)

FIGS. 2, 3. *Cornus hyperborea* Heer. (Page 29.)

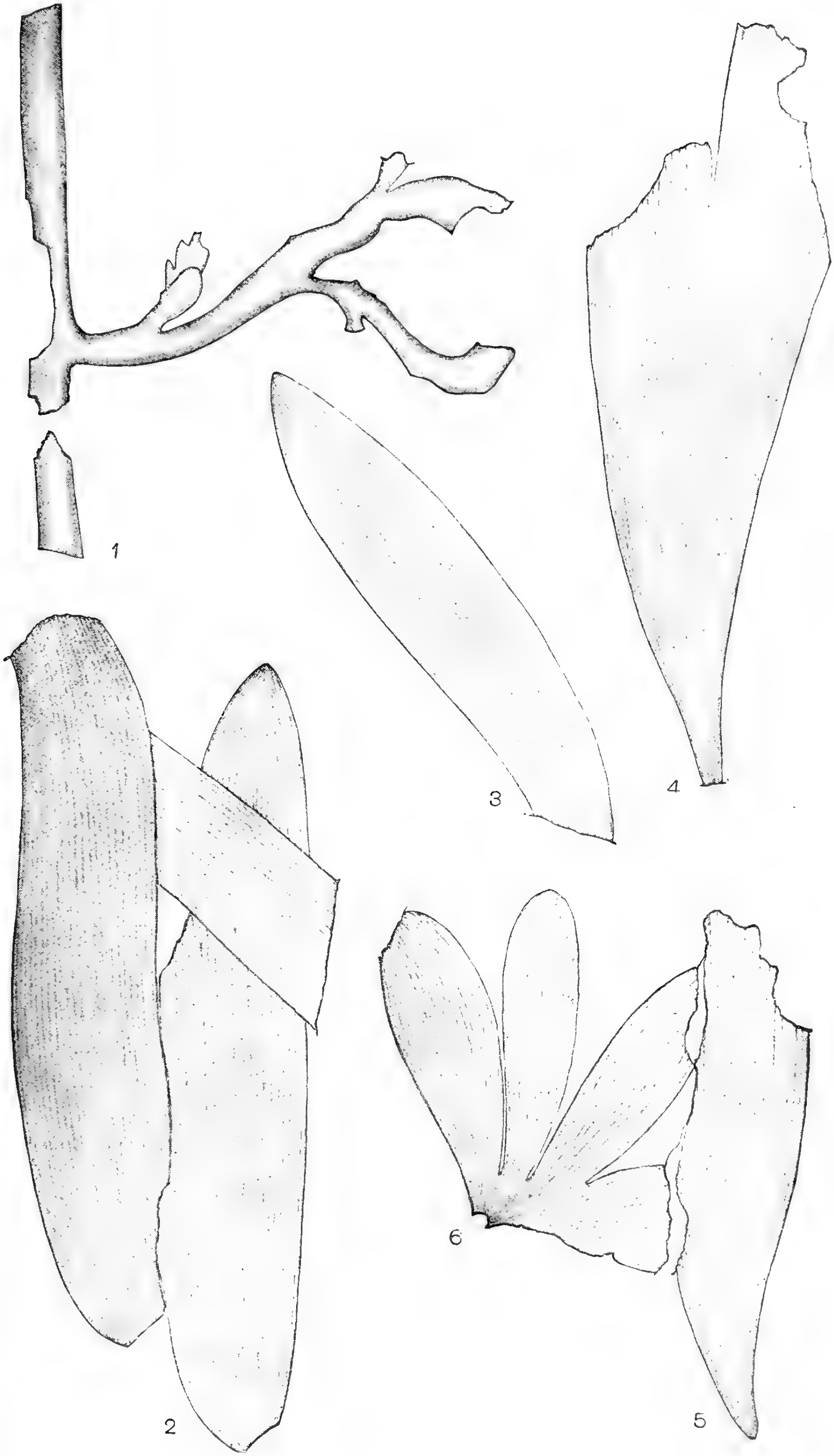


FIG. 1. *Chondrites filiciformis*, n. sp. (Page 32.)
FIGS. 2, 3. *Podozamites latipennis* Heer. (Page 31.)
FIGS. 4, 5. *Baiera palmata* Heer. (Page 31.)
FIG. 6. *Ginkgo multinervis* Heer. (Page 31.)

THE PALEONTOLOGIC HISTORY OF THE GENUS PLATANUS.

BY LESTER F. WARD.

(With Plates XVII-XXII.)

The paleontologic history of the horse and that of a number of other animals has been worked out to considerable satisfaction by zoologists, who have traced the lines of descent far back through geologic time and discovered their remote ancestors and many of the intermediate links in the phylogenetic chain. But in the vegetable kingdom few examples have presented themselves in which similar studies could be successfully undertaken. The fossil remains are too meager and imperfect and the affinities too doubtful, as a rule, to warrant any very wide generalizations relative to the genealogical history of plants. The case of the ginkgo tree presents a partial exception, and I once collected some of the evidence of the great antiquity of that singular and now nearly extinct form of plant life.* Our great trees of the Pacific coast (*Sequoia*) have also begun to attract attention from this point of view, since it has become known that their ancestral remains are abundant throughout the Tertiary and Upper Cretaceous strata of both hemispheres.†

With dicotyledonous plants the cases are still more rare, in consequence of the relatively recent appearance and brief geological history of this class. Baron von Ettingshausen has attempted to trace the chestnut tree back to an early ancestor in the Tertiary formation,‡ and more recently Dr. J. S. Newberry has introduced us to the ancestors of the tulip tree in the Cretaceous clays of New Jersey.§

Equally interesting with this latter, and, as we shall see, possibly allied to it, is the plane tree, or genus *Platanus*, of which only seven species survive in the present flora of the globe. Five of these seven species are comparatively rare and little known, only two of them being found within the limits of the United States in New Mexico and California. The two well-known species are the oriental plane tree (*Platanus orientalis*), and our abundant sycamore (*P. occidentalis*).

Few as are the living representatives of this type of vegetation, it is now known to have played a prominent part in the Tertiary history of the earth, and no less than twenty fossil species have been recognized. The greater part of these are from North American or Arctic strata, but

* See Science, Vol. V, June 19, 1885, p. 495.

† See Dr. Asa Gray's address as retiring president of the American Association for the Advancement of Science at Dubuque, August, 1872.

‡ Sitzb. d. Akad. d. Wiss., Bd. LXV, Abth. I, Wien, 1872, p. 147.

§ Bulletin of the Torrey Botanical Club, New York, Vol. XIV, January, 1887, p. 1.

several are found in the European Miocene. The Laramie group of the Rocky Mountain region, a formation which occupies a disputed position between the Cretaceous and Tertiary, and seems to span the boundary of Mesozoic and Cenozoic time, furnishes about half the known fossil forms. The species from this formation are all founded on the impressions of leaves, no inflorescence nor fruit having thus far been discovered. Among these leaves are some that deviate widely from those of living plane trees and seem to resemble those of *Aralia*. The most remarkable of these is the noble plane (*Platanus nobilis*) of Newberry, from the Upper Missouri country, or Fort Union group. This tree had a very large leaf, sometimes with a breadth of 2 feet, bearing a number of lobes, palmately disposed, and a considerable portion of the margin of the leaf was destitute of indentations or teeth. Smaller leaves having essentially the same form and nervation, but usually somewhat smoother on the margins, have been referred to *Aralia*. I have, however, collected great numbers of these leaves from beds on the Lower Yellowstone, where all the intermediate forms and sizes occurred in immediate association, so as to leave no doubt in my mind that they all belonged to the same type of plants. Fig. 1, Pl. XVII, represents one of these smaller forms, natural size.

This leaf has the usual form at the base for both the large and the small specimens, but others occurred having a remarkable expansion at the base of the blade, projecting backward on the leaf stalk and having from 2 to 5 lobes or points, as shown in figs. 2–5, Pls. XVII–XIX.

These expansions are to be interpreted as evidence that the leaves all belong to *Platanus* or to some extinct ancestral type of that genus, since something quite analogous to them is found in our American plane tree. The ordinary leaves of this tree are, it is true, destitute of basilar expansions, but those on young shoots, and sometimes those on the lower or non-fruit-bearing branches of trees, exhibit this peculiarity. Fig. 6, Pl. XIX, which represents a leaf from a small tree, shows it with considerable distinctness. Though less prominent, its resemblance to that of the fossil leaves is quite close.

In place of this backward expansion of the blade many sycamore leaves have an appendage similar in shape at the base of the leaf stalk, as though the once basilar appendage had been separated from the blade and crowded down the petiole to its point of insertion. This is very clearly shown in fig. 7, Pl. XX, from a young shoot with wedge-shaped leaves and very short petioles. More frequently these miniature blades are forced entirely off the petiole and are found grown together around the stem above the attachment of the leaf, so as not even to constitute true stipules. The constriction seen in the fossil forms between the blade of the leaf and the appendage would seem to represent the beginning of this process of detachment of the latter, and there is another fossil form (*Platanus appendiculata* Lx., fig. 8, Pl. XX) found in the much more recent auriferous gravels of California, which corresponds precisely in this respect with the living specimen last figured.

The history of this character in the leaf of the sycamore is thus quite satisfactorily traced as far back as the close of the Mesozoic age, but the type is much older. The next series below the Laramie at which an abundance of vegetable remains is found in the western portions of the United States is the Dakota group of Kansas and Nebraska, which is usually regarded as Middle Cretaceous, and is about the equivalent of those beds in Europe in which the most ancient dicotyledonous plants occur. Throughout this series there are found large-lobed leaves variously referred to *Platanus*, *Aralia*, *Liquidambar*, *Sassafras*, *Liriodendron*, and *Aspidiophyllum*. The most abundant of these forms has been called *Sassafras*, or *Araliopsis*, the latter designation having, however, been generally dropped. It would, of course, be wrong to say that all these forms belong to *Platanus*; but to predict that they will one day be recognized as interrelated, and as representing the remote ancestry of the plane and the sycamore, can, in the light of our present knowledge, scarcely be considered rash. It seems very doubtful whether *Liquidambar* and *Platanus* of the living flora are as dissimilar as would appear from their wide separation in the so-called natural system of classification. That *Aralia*, *Sassafras*, and *Liriodendron* represent branches of a common trunk from which the former genera have also descended, is much less probable, but not impossible. As regards *Sassafras*, however, to which genus the greater part of the fossil leaves are supposed to belong, there is no need, I think, of resorting to so violent an assumption, since it is extremely doubtful that the Dakota leaves belong to that type.

It is a common mistake to look upon the *Sassafras* as possessing primarily a three-lobed leaf. Even those who know that non-lobate leaves occur are apt to regard them as abnormal and the lobed ones as normal. It is a fact well known to botanists that, in the oaks and many other trees, only the leaves on fruit-bearing branches can be depended upon for the determination of species, and most modern botanists now regard the varying forms of leaf seen on young shoots and near the base of trees as valuable hints at the probable stages through which the final forms have passed in the history of their development.

In the *Sassafras*, after it has attained any considerable size, the greater part of the leaves are elongate and without lobes. These are almost the only leaves found on flowering or fruiting branches of the larger trees. The lobed leaves occur almost entirely on the lower, barren branches of such trees. Fig. 9, Pl. XX, represents a nearly typical leaf from a tree 18 inches in diameter, on which at least nine-tenths of the leaves were without lobes. Fig. 10, Pl. XXI, shows a lobed leaf from the lower portion of the same tree.

Returning to the nervation, it will be instructive to compare that of the lobed leaf of *Sassafras* with that of the so-called Sassafras leaves of the Dakota group. Fig. 11, Pl. XXI, represents the *Sassafras cretaceum* of Lesquereux.

The disposition of the nerves proceeding from the midrib to the sinuses is remarkably uniform in all *Sassafras* leaves, as any one can prove by observation; yet it is here that the widest difference is seen in the fossil forms. These, however, bear some resemblance to the fossil forms of *Platanus* and to those called *Aralia*, which are probably of the same type.

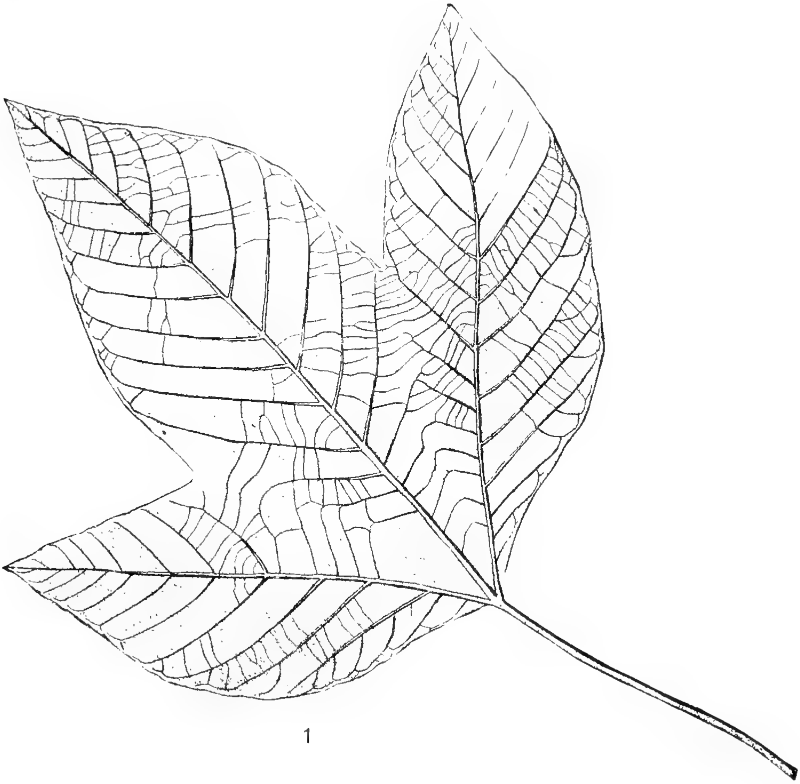
None of the supposed *Sassafras* or *Liquidambar* leaves of the Dakota group show the basilar expansions that occur in some of the species of *Platanus* of later age, but in the anomalous form which has been called *Aspidiophyllum* something analogous to them is seen. Figs. 12 and 13, Pl. XXII, represent the *Aspidiophyllum trilobatum* Lx., the first of which shows the three lobes and nervation, while in the second the expansion at the base is somewhat lobed.

It is remarkable that certain of the remote ancestors of our familiar tulip tree are found to approach this same type, at least in general form, and one species formerly referred by Professor Lesquereux to that genus (*Liriodendron*), but finally classed as an *Aspidiophyllum*, has the enlarged base of blade with narrow neck in singular imitation of the *Platanus* leaves of the Lower Yellowstone Valley.

As regards *Aralia*, none of the Cretaceous forms thus far found possess this feature, but one of the species which I have myself called by that name, the beautiful *Aralia digitata* from the Fort Union deposits (fig. 15, Pl. XXII), shows a decided tendency in this direction, and though small and deeply lobed into five narrow digits curiously like fingers of the human hand, I can see nothing in the general nervation, dentation, or form that differs essentially from those of the largest leaves of *Platanus nobilis* from rocks of the same age.

The American origin of our sycamore was long denied by Willdenovius and other European botanists, and was only rendered certain by its discovery in a fossil state by Professor Lesquereux in a late deposit of the Mississippi Valley. Specimens were sent to that great authority on these subjects, Dr. Oswald Heer, of Zürich, who could find no characters by which to distinguish the fossil from the living form and who regarded this as a final settlement of the question.* But we have now learned that not only this most abundant species, not only the greater number of the living species are American, but that the genus itself, the entire type of vegetation to which the planes belong, is American, and that numerous and strange archaic forms of this type not only formed the umbrageous forests on the shores of the great inland Laramie sea where the Rocky Mountains now stand, but also those of the ocean at a time when it still pushed its arms northward across what are now the great plains of Texas, Colorado, and Wyoming.

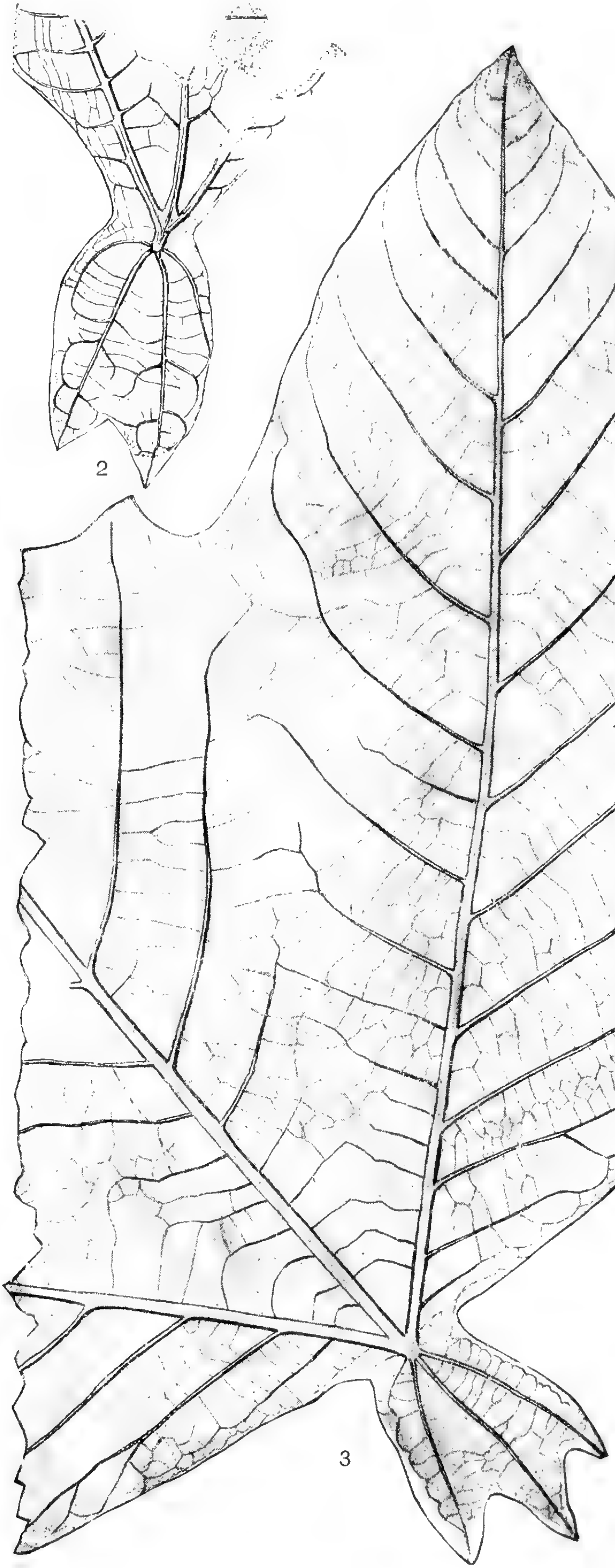
*Bulletin de la société Vandoise, Tome V, Lausanne, 1858, p. 144.



1

4

FIG. 1. *Aralia notata* Lx. (red. ½). (Page 40.) FIG. 4. *Platanus basilobata* Ward (red. ½). (Page 40.)

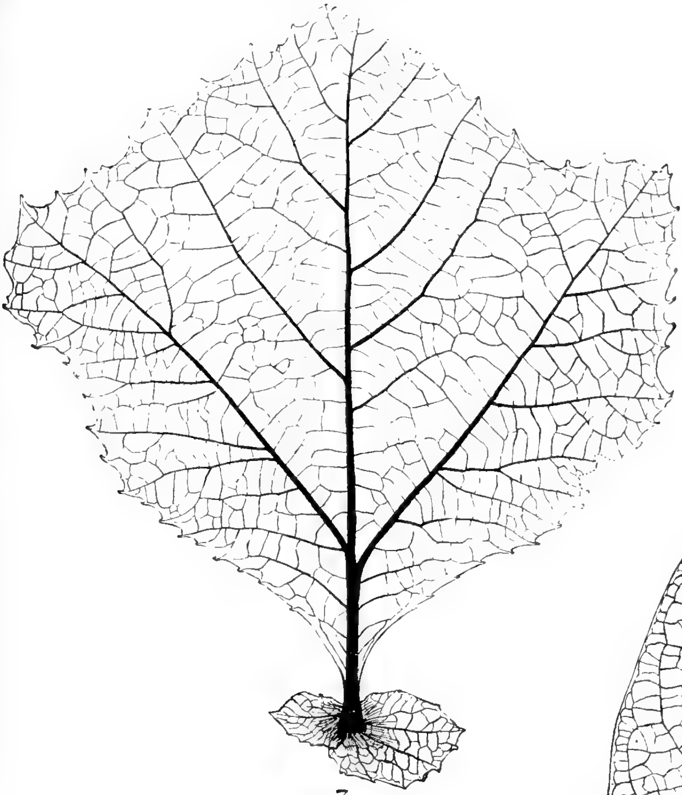


FIGS. 2, 3. *Platanus basilobata* Ward. (Page 40.)

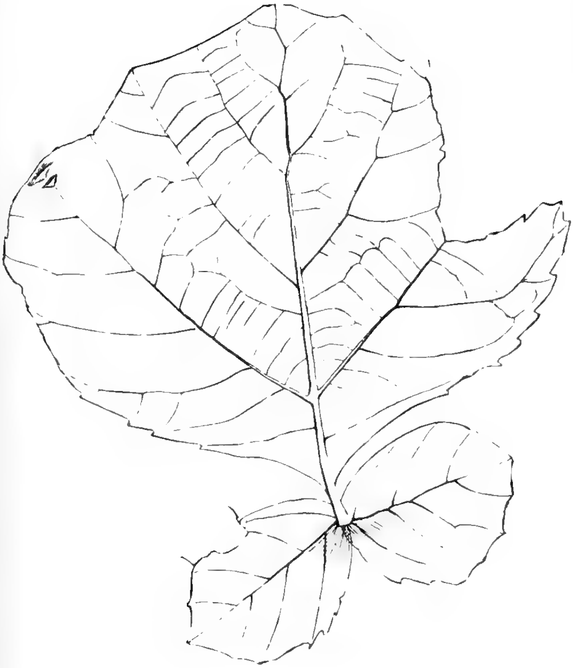
5

6

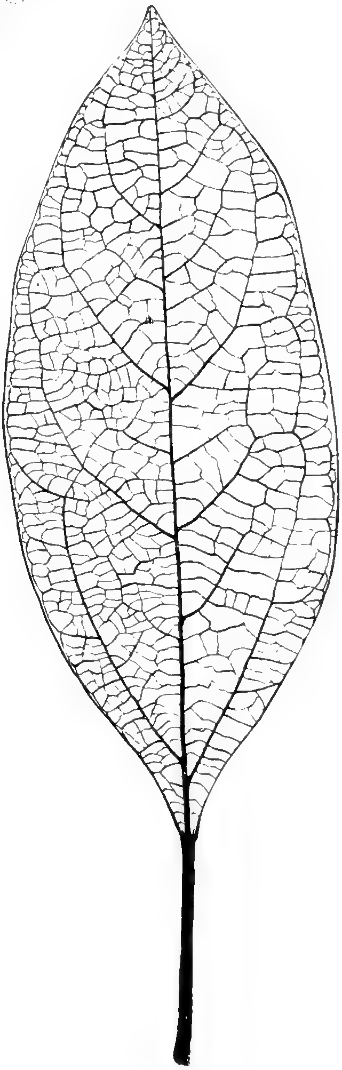
FIG. 5. *Platanus basilobata* Ward. (Page 40.) FIG. 6. *Platanus occidentalis* L. (red. 4 diam.). (Page 40.)



7



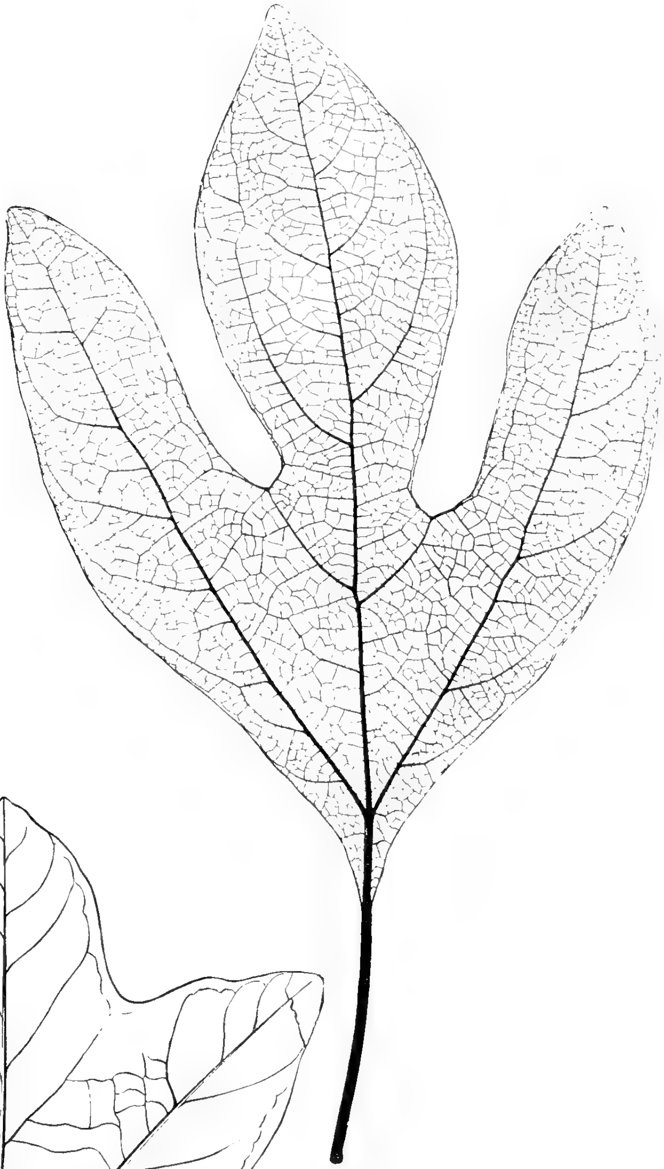
8



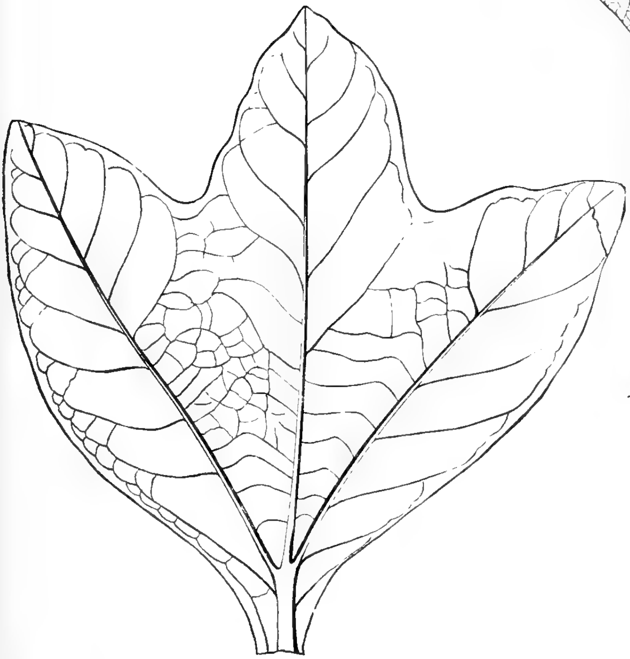
9

FIG. 7. *Platanus occidentalis* L. (red. [illegible]). (Page 40.)
FIG. 8. *Platanus appendiculata* Lx. (red. [illegible]). (Page 40.)

FIG. 9. *Sassafras officinale* Nees (red.). (Page 41.)



10

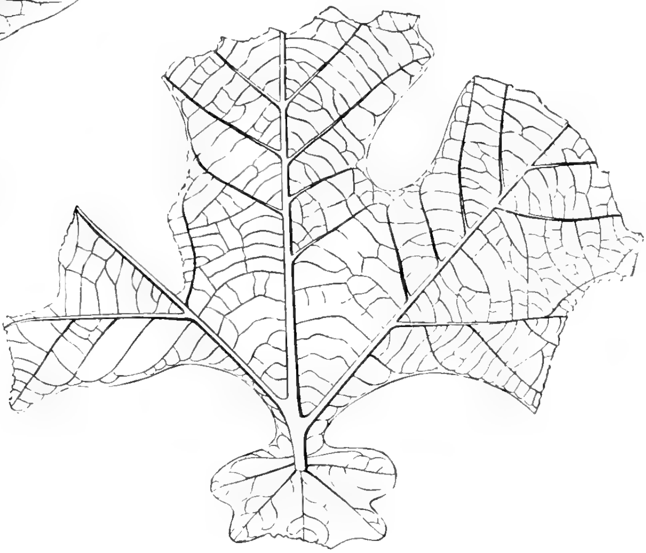


11

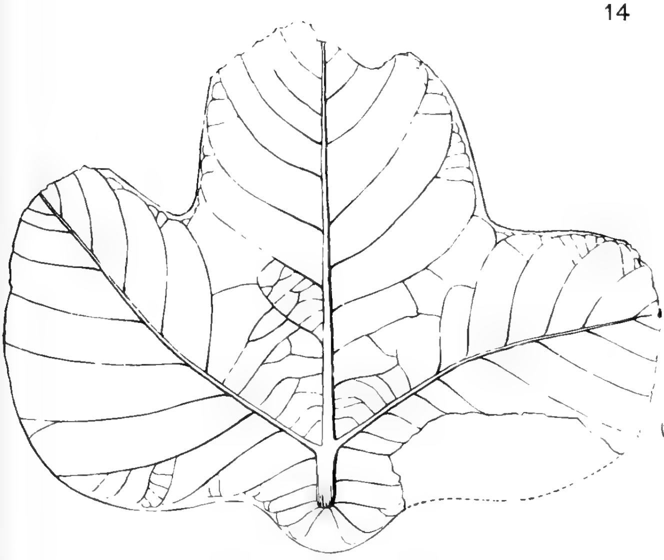
FIG. 10. *Sassafras officinale* Nees (red.). (Page 41.)

FIG. 11. *Sassafras cretaceum* Lx. (Page 41.)

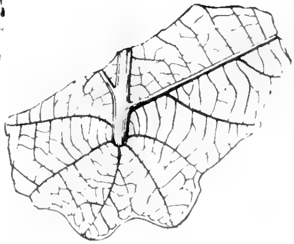
15



14



12



13

FIGS. 12, 13. *Aspidiophyllum trilobatum* Lx. (red. ⅓). (Page 42.)

FIG. 14. *Aspidiophyllum dentatum* Lx., sp. ined. (red. ⅓). (Page 42.)

FIG. 15. *Aralia digitata* Ward. (Page 42.)

NOTES ON INDIANA FISHES.

BY BARTON W. EVERMANN AND OLIVER P. JENKINS.

The material upon which the following paper is based consists chiefly of collections made (1) in the streams flowing through Carroll County, in August, 1887, by B. W. Evermann; (2) in Lake Maxinkuckee and the Tippecanoe River, in August, 1886, by O. P. Jenkins; (3) in southeastern Indiana, made at various times by the writers and W. P. Shannon; and (4) in Dearborn and Ohio Counties, in August, 1887, by O. P. Jenkins. Most of the collecting was done with a small Baird seine.

UPPER WABASH AND ITS TRIBUTARIES.

Collections were made in the Wabash, the Tippecanoe, Deer Creek, Little Deer Creek, Wild Cat Creek, and Honey Creek. Less than a day was devoted to the Wabash River at Delphi. About two days each were given to Deer Creek and Wild Cat Creek, good-sized creeks flowing nearly due west through Carroll County, the first emptying into the Wabash near Delphi, the second, near La Fayette. Little Deer Creek is a small branch of Deer Creek a few miles north of Wild Cat, while Honey Creek is a small stream which flows into Wild Cat from the southeast about 3 miles east of the Carroll County line. About a half day was given to each of these, in Honey Creek at Russiaville, and in Little Deer Creek near the east line of the county. Wild Cat was seined in the vicinity of Burlington and Deer Creek at Camden, 10 miles above its mouth.

All these creeks flow over bottoms more or less rocky or gravelly, with occasional stretches of sand or mud.

Most of the collection from the Tippecanoe River was made by Mr. O. P. Jenkins, in August, 1886, while floating in a boat down that stream from Lake Maxinkuckee. Hauls were made at various places from where the Logansport and Terre Haute Railroad crosses the river, to its mouth, 10 miles below Delphi.

1. **Petromyzon concolor** (Kirtland.) *Silvery Lamprey.*

One specimen, 9 inches long, taken in the Wabash River at Delphi. The only other Indiana records, so far as we are able to learn, are those given by Dr. Jordan of one taken at New Albany and one in the White River at Indianapolis.

2. **Polyodon spathula** (Walbaum). *Spoon-bill Cat.*

No specimens of this species were obtained, but several years ago I had a specimen which had been taken from the Wabash near Delphi. (Evermann.) It is still reported to be common in the spring.

3. **Scaphirhynchus platorhynchus** (Raf.). *Shovel-nosed Sturgeon.*

Occasionally seen in the Wabash. Several years ago I had a specimen from the river near Delphi. (Evermann.)

4. **Lepisosteus osseus** (L.). *Common Gar.*

Common in the Wabash and Tippecanoe Rivers, especially in the spring.

5. **Noturus gyrinus** (Mitchill).

One specimen taken in the Wabash and one in Little Deer Creek.

6. **Noturus miurus** Jordan.

Specimens of this species were obtained in Wild Cat Creek, Deer Creek, and the Wabash, but it does not appear to be very common in any of these streams.

7. **Noturus exilis** Nelson.

One specimen taken in the Tippecanoe. (Jenkins.)

8. **Noturus flavus** Rafinesque. *Yellow Stone-Cat.*

Taken in Wild Cat, the two Deer Creeks, and the Wabash, in all of which it was rather common. It was not found in Honey Creek, in fact no species of Catfish was seen in that stream.

9. **Ameiurus melas** (Raf.).

A few specimens taken in each of the two Deer Creeks. (E.) Common in the Tippecanoe. (J.)

10. **Ameiurus nebulosus** (Le Sueur).

One specimen from the Tippecanoe. (J.)

11. **Ameiurus natalis** (Le S.)

Found only in the two Deer Creeks. Rare.

12. **Ameiurus nigricans** Le S. *Mississippi Cat.*

Frequent in the Wabash where I have seen it. (E.)

13. **Ictalurus punctatus** (Raf.). *Channel Cat.*

Common in the Wabash, but less so in the Tippecanoe. Specimens were obtained from each stream.

14. **Ictiobus cyprinella** (Cuv. & Val.). *Red-mouthed Buffalo.*

Frequently taken by fishermen from the Wabash, but none were seen at this time.

15. **Ictiobus urus** (Agassiz). *Razor-backed or Mongrel Buffalo.*

Found only in the Wabash. Less common than the preceding.

16. **Ictiobus bubalus** (Raf.). *Sucker-mouthed Buffalo.*

Rather common in the Wabash. No specimens of these last three species were obtained, but I have seen them all at other times in the Wabash at Delphi. (E.)

17. **Ictiobus velifer** (Raf.). *Quill-back.*

Quite common in the Wabash, but less so in the Tippecanoe.

18. Catostomus teres (Mitchill). *Fine-scaled Sucker.*

Rather common in all the streams.

19. Catostomus nigricans Le S. *Hog Sucker.*

Common everywhere.

20. Erimyzon sucetta oblongus (Mitchill.) *Chub Sucker.*

Found only in Little Deer Creek and Honey Creek, from which but three specimens were obtained.

21. Moxostoma duquesnei (Le S.) *Red Horse.*

Abundant everywhere except in Honey Creek, where it was not noticed.

22. Moxostoma crassilabre Cope. *Red Horse.*

Not seen at this time, but there is a specimen in Dr. Jordan's collection at the Indiana University which I collected in Deer Creek, near Camden, in 1884. (E.)

23. Placopharynx carinatus Cope. *Big-jawed Sucker.*

I examined three specimens of this large sucker which had just been taken in the Tippecanoe River by Mr. Harry Van Der Volgen, who reports it to be rather common in both the Tippecanoe and the Wabash. In Dr. Jordan's Report on the Fishes of Ohio he mentions "a pair of pharyngeal bones of this species taken by Dr. G. M. Levette from a specimen taken in the Wabash at Terre Haute, where the fish is said to be abundant." Since examining these three from the Tippecanoe, I have seen several specimens from the Wabash in the Terre Haute market, but I can not say that it is really "abundant" at that place. In the same connection Dr. Jordan mentions "a pharyngeal bone from 'post-Pliocene' deposits at the Falls of the Ohio, by Dr. John Sloan." (Evermann.)

These are, so far, the only records of its occurrence in Indiana. It will probably be found, however, in all the large streams.

24. Lagochila lacera Jordan & Brayton. *Hare-lip Sucker.*

It affords us pleasure to add this interesting fish to Indiana's known fish fauna. On August 25, 1887, two specimens were taken by Mr. Harry Van Der Volgen in the Tippecanoe River, west of Delphi, and were examined by Mr. Evermann at that time. Mr. Van Der Volgen informs us that he has also taken it in the Wabash, but does not think it to be very common in either stream.

It is known here as the Pea-lip Sucker. Until now the species, described in 1877 by Professors Jordan and Brayton, had been reported only from the Scioto, Clinch, and Chickamauga Rivers, and White River, Arkansas. This is, therefore, the first record of its appearance in Indiana.

25. Campostoma anomalum (Raf.). *Stone-roller.*

An abundant species in all the streams of the county.

26. Chrosomus erythrogaster Raf. *Red-bellied Dace.*

This pretty minnow was not seen in any of the streams of Carroll County, but was quite common in Honey Creek, just over the line, in Howard County. This little stream, which flows into Wild Cat a few miles east of the east line of Carroll County, is fed almost exclusively by springs, and the water is perceptibly colder than that of any of the other streams which were seined. This fact accounts for the presence in this stream of both this species and the Black-nosed Dace.

27. Hybognathus nuchalis Agassiz. *Silvery Minnow.*

Noticed only in Wild Cat, Little Deer Creek, and the Wabash, but it doubtless occurs in all the streams of the county.

28. Pimephales notatus (Raf.). *Blunt-nosed Minnow.*

Abundant in all the streams.

29. Cliola vigilax Baird & Girard. *Bull-head Minnow.*

We found this species only in the Wabash, where we obtained a few specimens.

30. Notropis deliciosus (Girard).

Not uncommon in both the Wabash and Tippecanoe, where about a dozen specimens were taken. These specimens are of the variety *stramineus*, as given in Jordan & Gilbert's Synopsis of Fishes of North America, but Professor Gilbert informs us that he now sees no good reason for separating the two. The lateral line in these specimens now before us counts from 34 to 38, thus justifying Professor Gilbert's conclusion.

31. Notropis boöps Gilbert.

A single specimen, which we refer with some doubt to this species, was taken in the Wabash. It agrees with *boöps*, except that there is no angle in front of the dorsal, the anterior profile being gently curved, the number of scales in the lateral line is 30 instead of 36, and there is a small dark blotch at the base of the dorsal fin. (E.)

32. Notropis whipplei Girard.

Abundant everywhere except in Honey Creek, where it was not found.

33. Notropis megalops (Raf.).

Common in all streams seined.

34. Notropis lythrurus Jordan.

A few specimens were taken in each stream seined, except the Tippecanoe.

35. Notropis atherinoides (Raf.).

Found to be rather common in all the streams except Honey Creek and Little Deer Creek, where none were seen.

36. Notropis arge (Cope).

This species was originally described in 1866 by Prof. E. D. Cope, from specimens probably from southeastern Michigan, whether from the Detroit River or from St. Joseph River of the Maumee he did not know.

Dr. Jordan has always regarded it as identical with *Notropis atherinoides* (Raf.), but upon examining specimens from Wild Cat and Deer Creek he agrees with us in regarding it as a good species.

As the only printed description of this species is that found in Cope's "Cyprinidæ of Pennsylvania," 1866, p. 387, it seems desirable to reprint it in this connection:

"*Alburnellus arge* Cope. Diameter of orbit greater than length of muzzle, three times in length of head; head five and one-half times in total, four and one-half to base of tail. Scales 5–39–3. A dark vertebral line and definite lateral silver band." And in a foot note:

"*Alburnellus arge*, m. sp. nov. Also an elongate species, less than the preceding, with deeper head and larger eye. Muzzle from orbit less than diameter of latter; end of os maxillare opposite anterior rim of same; mandible acuminate, not projecting when closed, no symphysel knob. Frontal breadth two thirds temporal and three-fourths orbital. Greatest depth a little over seven times in total length, equal from end muzzle to preopercular border. Proportion and formula of fins as in the last [*Alburnellus jaculus*=*Notropis atherinoides*]. Lateral line straight. A silver band along anteriorly above the latter, dark-edged above and below. Muzzle and lips blackish. Length, 2.75.

"*Habitat:* Either Detroit River or the St. Joseph's; the locality confused. Numerous specimens."

The species differs quite evidently from *Notropis atherinoides*, the species which it most resembles. It is more slender, the snout is heavier and not so pointed, the eye is larger, equaling the interorbital space and exceeding the snout, $3\frac{1}{5}$ in head, while in *N. atherinoides* the eye does not equal the interorbital space, just equals the snout, and is contained $3\frac{1}{2}$ times in head. The origin of the dorsal in *N. arge* is but little nearer end of snout than base of caudal; in the other it is midway between end of snout and free end of caudal; the first has a broad plumbeous lateral band, bordered below with silvery, extending straight from the opercle to base of caudal, while in the second this line is little more than a silvery one. *Notropis arge* has a well-marked black vertebral line, which is scarcely evident in *atherinoides*, and the lateral line is less decurved than in *atherinoides*.

D., 8; A., 10; eye, $3\frac{1}{5}$; head, 4; depth, $5\frac{3}{5}$; lateral line, 5–40–4; teeth, 2–4–4–2.

37. Notropis rubrifrons (Cope).

Six specimens from Wild Cat, a dozen from Deer Creek, seven from the Wabash, and many from the Tippecanoe. Not noticed elsewhere.

38. **Ericymba buccata** Cope.

Abundant everywhere.

39. **Rhinichthys atronasus** (Mitchill).

This species was found only in Honey Creek, where out three specimens were taken. Special search was made for it and *Chrosomus erythrogaster* in several other streams, but without finding it.

40. **Hybopsis kentuckiensis** (Raf.). *River Chub.*

Common everywhere.

41. **Hybopsis amblops** (Raf.)

Specimens are in the collections from Wild Cat, Deer Creek, the Wabash, and the Tippecanoe, in all of which it was tolerably common.

42. **Hybopsis dissimilis** (Kirtland).

Found only in the Wabash and Tippecanoe. Common.

43. **Hybopsis hyostomus** Gilbert.

This minnow was described in 1881 by Prof. Chas. H. Gilbert, from specimens taken by him in the East Fork of White River at Bedford, Ind. Other specimens were afterwards taken at Gosport from the West Fork of White River, these being the only Indiana records.

It was quite common in the Wabash at Delphi, numerous specimens being taken at nearly every haul in the river channel.

44. **Semotilus atromaculatus** (Mitchill). *Chub.*

Common. Specimens from Little Deer Creek, Deer Creek, Wabash, and Honey Creek.

45. **Notemigonus crysoleucas** (Mitchill). *Golden Shiner.*

One or two specimens from Deer Creek—the only stream in which it was found.

46. **Hiodon tergisus** Le Sueur. *Toothed Herring.*

Found only in the Tippecanoe, where several specimens were taken. (E.)

47. **Clupea chrysochloris** (Raf.). *Ohio Shad.*

A few specimens were obtained from the Wabash.

48. **Dorosoma cepedianum** (Le Sueur). *Hickory Shad.*

Common in the Wabash. Not seen elsewhere.

49. **Zygonectes notatus** (Raf.). *Top Minnow.*

One large specimen and several small ones taken in Wild Cat, and a few small ones in Deer Creek.

50. **Umbra limi** (Kirtland). *Mud Minnow.*

A few specimens were obtained in Little and Big Deer Creeks, while in Honey Creek it was very abundant. In the spring of 1879 I found a number of specimens in cow-tracks and other small depressions at the lower end of the Armstrong Pond at Camden. (E.)

51. Esox vermiculatus Le Sueur. *Pike; Little Pickerel.*

Specimens were obtained from both Deer Creeks, Wild Cat, the Wabash, and Tippecanoe.

52. Anguilla anguilla rostrata (Le Sueur). *Common Eel.*

No eels were seen at this time, but on former occasions I have seen specimens from Wild Cat, Deer Creek, and the Wabash. In 1883 I got two fine ones from Deer Creek, near Camden. (E.)

53. Labidesthes sicculus Cope. *Skip-jack; Brook Silverside.*

Common in Wild Cat, Wabash, and Tippecanoe. Rare in Deer Creek.

54. Pomoxis sparoides (Lacépède). *Calico Bass.*

Noted only in the Wabash, where it appears to be rather common.

55. Ambloplites rupestris (Raf.). *Red-eye; Goggle-eye.*

Common. Specimens obtained from all the streams except Honey Creek, where it was not seen.

56. Lepomis cyanellus (Raf.). *Common Sunfish.*

Apparently common everywhere except in Honey Creek, where no specimens of the genus were seen.

57. Lepomis megalotis (Raf.).

The collection contains specimens from all the streams seined except Honey Creek.

58. Lepomis pallidus (Mitchill).

Not seen anywhere except in the Tippecanoe, where I found it to be common. (J.)

59. Micropterus salmoides (Lacépède). *Large-mouthed Black Bass.*

Apparently not common, but most so in the larger streams. Taken in Wild Cat, Deer Creek, Wabash, and the Tippecanoe.

60. Micropterus dolomieu Lacépède. *Small-mouthed Black Bass.*

Much more common than the preceding. Numerous specimens taken in all the streams except Honey Creek, where none were seen.

61. Etheostoma pellucidum Baird. *Sand Darter.*

Apparently rare in all the streams except the Wabash and Tippecanoe. Only one specimen was obtained in Wild Cat, although careful search was made for it, and none were found in Honey Creek, Little Deer Creek, or Deer Creek; in the last, however, several specimens were seen in 1884 and 1885. It was found to be very abundant in the Wabash just below Delphi and Pittsburgh bridge.

62. Etheostoma pellucidum clarum Jordan & Meek.

In the Proceedings of the U. S. National Museum for 1885 (p. 8), Professors Jordan and Meek described the supposed new Darter, *Ammocrypta clara*, from the Des Moines River at Ottumwa, Iowa. These

Nov. 8, 1888.

specimens differed from *E. pellucidum* chiefly in the less complete squamation, "the cheeks and opercles [being furnished] with rather few thin scales imbedded in the skin," and the "body naked, except for a strip of scales along the lateral line, consisting of five or six series of small imbedded, wide-set, ctenoid scales. On the caudal peduncle this band widens out, covering the whole depth of the tail."

In typical *E. pellucidum*, the cheeks, temporal region, and opercles are covered with imbedded, more or less cycloid scales.

A large lot of "Sand Darters" were collected in the Wabash at Delphi, and an examination of the series shows that there are several specimens which fill the description of *E. clarum* very well, while others show all degrees of squamation from the very imperfectly scaled *clarum* to the almost completely scaled *pellucidum*. In some specimens the cheeks are bare and the opercles densely scaled, in others the opercles have but few scales, while in yet others no scales can be detected upon the head at all. Corresponding differences are found in the scales of the body, some almost scaleless, others with a few rows along the lateral line, and others with more and more rows. No constant or important differences can be noticed in measurements.

The dorsal rays of a large series were counted and X–10 was found to be the usual number, though a few counted IX–10, and one XI–10.

From a consideration of these facts we feel justified in reducing *E. clarum* to subspecific rank, making it stand as *Etheostoma pellucidum clarum*.

We may add that specimens recently collected from the Wabash at Terre Haute show a similar gradation, with possibly a greater percentage of the subspecific form.

63. **Etheostoma nigrum** Raf. *Johnny Darter.*

Everywhere; perhaps the most abundant Darter of the region. Some exceedingly large individuals were obtained in Honey Creek.

64. **Etheostoma blennioides** Raf. *Green-sided Darter.*

Rather common in Wild Cat, but less so in the two Deer Creeks and the Wabash. Found by Professor Jenkins in the Tippecanoe. Not seen in Honey Creek.

65. **Etheostoma copelandi** (Jordan).

Abundant in the Wabash at Delphi, but not seen elsewhere. This little Darter was first described in 1877, by Dr. Jordan, from the White River at Indianapolis. Since then it has been reported from the White River at Gosport, Ind., and numerous specimens were taken in September, 1887, by Professor Evermann, from the Wabash, at Terre Haute. The home of the species seems to be in Arkansas, it having been found very common in tributaries of the Arkansas River near Fort Smith, and in the Washita at Arkadelphia. and the Saline at Benton by Professors Jordan and Gilbert.

66. **Etheostoma shumardi** (Girard).

Two specimens from the Wabash at Delphi. This species was described by Girard in 1859 from the Arkansas River. Since then other specimens have been obtained by Dr. Jordan from the Wabash, opposite Hutsonville, Ill., by Professor Forbes from the Illinois River, and by Jordan & Gilbert in the Arkansas. So this is the second Indiana record of the species.

67. **Etheostoma caprodes** (Raf.) *Log Perch.*

One specimen from Wild Cat and a few each from the two Deer Creeks and the Wabash. Professor Jenkins obtained it from the Tippecanoe.

68. **Etheostoma phoxocephalum** Nelson.

Four fine specimens of this beautiful Darter were taken in the Wabash at Delphi. I have since obtained it in the Wabash, at Terre Haute. (E.)

69. **Etheostoma aspro** Cope & Jordan. *Black-sided Darter.*

Not uncommon in Wild Cat, the two Deer Creeks, and the Wabash. Taken by Jenkins in the Tippecanoe.

70. **Etheostoma evides** Jordan & Copeland.

A single specimen taken in the Wabash at Delphi, and two specimens taken by Professor Jenkins in the Tippecanoe. The other Indiana localities from which it has been reported are the West Fork of White River at Indianapolis, and Gosport.

71. **Etheostoma scierum** (Swain).

One specimen gotten in the Tippecanoe. (J.)

This interesting Darter, described in 1883 by Professor Swain, from Bean Blossom Creek, Indiana, is said to be abundant in the streams of Arkansas and Texas. It has been taken in Indiana only in the Tippecanoe, West Fork of White River, at Gosport, Bean Blossom, and Salt Creek.

72. **Etheostoma camurum** (Cope).

One specimen taken in the Tippecanoe by Professor Jenkins. Found by Dr. Jordan also in the White River at Indianapolis. These are the only Indiana records.

73. **Etheostoma flabellare** Raf.

None seen in Honey Creek, but rather common in all the other streams.

74. **Etheostoma cœruleum** Storer. *Rainbow Darter.*

Everywhere; one of the most abundant and generally distributed of the Darters. The specimens taken in Honey Creek and some from the other small streams are of the *spectabile* form described by Agassiz in 1854, but there seems to be no sufficient difference to justify any separation.

75. Etheostoma jessiæ (Jordan & Brayton).

A single specimen of this species was taken in the Wabash at Delphi. Total length, 48mm; length to base of caudal, 40mm; eye, 5, longer than snout; head, 4; depth, $4\frac{3}{4}$; D., XI–11; A., II–7; scales, 6–52–8; tubes developed on about 38. Cheeks and opercles well scaled. The lower jaw is a little longer than the upper.

This Darter, described in 1878 by Professors Jordan & Brayton from the Chickamauga River, Georgia, was redescribed a little later by Dr. Forbes under the name *Pœcilichthys asprigenis*, from a small creek at Pekin, Ill., and again by Dr. Jordan in 1884 as *Pœcilichthys swaini* from a single specimen from a tributary of the Pearl River, Mississippi. All these are now regarded by Dr. Jordan as one species.

Several specimens were collected by Jordan & Gilbert in the Sabine River, at Longview, Tex., in September, 1884.* The above are the only localities from which it has been reported outside of Illinois.

76. Etheostoma eos Jordan & Copeland.

Apparently quite rare; one specimen taken in the Tippecanoe. (J.)

77. Cottus richardsoni Agassiz. *Miller's Thumb.*

A few specimens were taken in each of the two Deer Creeks, while in Honey Creek it was found to be very common. Exceedingly large specimens were obtained from this creek.

In the following tabulated statement an attempt is made to indicate the distribution and abundance of each species in the various streams from which collections were made. The relative abundance of each species in each stream is indicated by the figures—1 (*very rare*), 2 (*rare*), 3 (*tolerably common*), 4 (*common*), 5 (*abundant*).

	Species.	Tippecanoe River.	Wabash River.	Deer Creek.	Little Deer Creek.	Wild-Cat Creek.	Honey Creek.
	PETROMYZONTIDÆ.						
1	*Petromyzon concolor* (Kirtland)	....	1	....	....	....	....
	POLYODONTIDÆ.						
2	*Polyodon spathula* (Walbaum)	....	2	....	....	....	....
	ACIPENSERIDÆ.						
3	*Scaphirhynchus platyrhynchus* Raf.	....	2	....	....	....	....
	LEPIDOSTEIDÆ.						
4	*Lepisosteus osseus* L	4	4	....	....	....	....
	SILURIDÆ.						
5	*Noturus gyrinus* (Mitchill)	....	1	....	1	....	....
6	*Noturus miurus* Jordan	....	2	2	....	2	....
7	*Noturus exilis* Nelson	1	....	....	....	....	....
8	*Noturus flavus* Rafinesque	....	4	4	4	4	....

* Proc. U. S. Nat. Mus. 1886, 16.

	Species.	Tippecanoe River.	Wabash River.	Deer Creek.	Little Deer Creek.	Wild-Cat Creek.	Honey Creek.
	PETROMYZONTIDÆ—Continued.						
9	*Ameiurus melas* Raf	2	...	1	1	...	...
10	*Ameiurus nebulosus* Le Sueur	1	...	...	...	...	...
11	*Ameiurus natalis* Le S .)	...	...	1	2	...	...
12	*Ameiurus nigricans* (Le S	...	3	...	...	...	...
13	*Ictalurus punctatus* (Raf.)	3	4	..	..	...	...
	CATOSTOMIDÆ.						
14	*Ictiobus cyprinella* Cuv. & Val	...	3	...	...	...	...
15	*Ictiobus urus* Agassiz	...	2	...	...	...	...
16	*Ictiobus bubalus* (Raf.)	...	4	...	...	...	...
17	*Ictiobus velifer* Raf	4	5	...	...	...	...
18	*Catostomus teres* Mitchill	4	5	5	5	5	5
19	*Catostomus nigricans* Le S	5	5	5	5	5	4
20	*Erimyzon sucetta oblongus* Mitchill	...	..	...	1	...	1
21	*Moxostoma duquesnei* (Le S.)	5	5	5	5	5	...
22	*Moxostoma crassilabre* Cope	...	...	1	...	...	...
23	*Placopharynx carinatus* Cope	2	...	...	...	...	...
24	*Lagochila lacera* Jor. & Brayt	1	..	...	...	...	...
	CYPRINIDÆ.						
25	*Campostoma anomalum* (Raf.)	5	5	5	5	5	5
26	*Chrosomus erythrogaster* Agassiz	...	...	...	...	...	5
27	*Hybognathus nuchalis* Agassiz	...	3	...	3	3	...
28	*Pimephales notatus* (Raf.)	5	5	5	5	5	5
29	*Cliola vigilax* Baird & Girard	...	2	...	...	...	...
30	*Notropis boöps* Gilbert	..	1	...	...	...	...
31	*Notropis whipplei* Girard	5	5	5	5	5	...
32	*Notropis megalops* Raf.	5	4	4	4	4	4
33	*Notropis lythrurus* Jor	...	2	2	2	3	2
34	*Notropis deliciosus* Girard	...	2	...	...	...	...
35	*Notropis atherinoides* Raf.	5	3	2	...	4	...
36	*Notropis rubrifrons* (Cope.)	5	4	4	...	3	...
37	*Notropis arge* (Cope)	...	...	4	...	3	...
38	*Ericymba buccata* Cope	5	5	5	5	5	5
39	*Rhinichthys atronasus* (Mitch.)	...	...	...	...	...	2
40	*Hybopsis kentuckiensis* Raf	5	2	3	3	3	3
41	*Hybopsis amblops* (Raf.)	4	2	2	...	3	...
42	*Hybopsis dissimilis* Kirtland	4	3	...	...	...	...
43	*Hybopsis hyostomus* Gilbert	...	5	...	...	...	...
44	*Semotilus atromaculatus* Mitch	...	2	3	3	...	3
45	*Notemigonus chrysoleucas* (Mitch.)	...	...	2	...	...	...
	HIODONTIDÆ.						
46	*Hiodon tergisus* Le S	3	...	...	...	...	...
	CLUPEIDÆ.						
47	*Clupea chrysochloris* (Raf)	...	3	...	...	...	...
	DOROSOMIDÆ.						
48	*Dorosoma cepedianum* (Le S.)	...	4	..	...	...	...
	CYPRINODONTIDÆ.						
49	*Zygonectes notatus* (Raf.)	...	..	2	...	2	...
	UMBRIDÆ.						
50	*Umbra limi* (Kirtland)	...	...	3	3	...	5
	ESOCIDÆ.						
51	*Esox vermiculatus* Le S.	...	3	3	3	3	...
	ANGUILLIDÆ.						
52	*Anguilla anguilla rostrata* Le Sueur	...	2	2	...	2	...
	ATHERINIDÆ.						
53	*Labidesthes sicculus* Cope	3	3	2	...	3	...

	Species.	Tippecanoe River.	Wabash River.	Deer Creek.	Little Deer Creek.	Wild-Cat Creek.	Honey Creek.
	CENTRARCHIDÆ.						
54	*Pomoxis sparoides* Lacépède	.	3	..	...	..	....
55	*Ambloplites rupestris* Raf	3	3	4	2	3	....
56	*Lepomis cyanellus* Raf	4	4	4	4	4	....
57	*Lepomis megalotis* Raf	2	5	3	2	3	....
58	*Lepomis pallidus* (Mitch.)	4		..	...	....	....
59	*Micropterus salmoides* Lacépède	2	3	2	....	2	....
60	*Micropterus dolomieu* Lac	4	4	4	4	4	....
	PERCIDÆ.						
61	*Etheostoma pellucidum* Baird	4	5	2	...	1	....
62	*Etheostoma pellucidum clarum* Jordan & Meek	...	2	..	...	....	....
63	*Etheostoma nigrum* Raf	5	5	5	5	5	5
64	*Etheostoma blennioides* Raf	4	3	3	3	4	....
65	*Etheostoma copelandi* Jordan	..	5	..	...	...	....
66	*Etheostoma shumardi* (Girard)	..	1	..	...	..	....
67	*Etheostoma caprodes* (Raf.)	1	3	3	3	1	....
68	*Etheostoma phoxocephalum* Nelson	..	2	..	...	....	....
69	*Etheostoma aspro* Cope & Jordan	2	3	3	3	3	....
70	*Etheostoma evides* Jordan & Copeland	1	1	..	...	..	....
71	*Etheostoma scierum* (Swain)	1	....		..	...	....
72	*Etheostoma camurum* Cope	1	....		...	....	....
73	*Etheostoma flabellare* Raf	3	3	3	3	1	....
74	*Etheostoma cœruleum* Storer	5	5	5	5	5	5
75	*Etheostoma jessiæ* Jor. & Brayt	..	1	..	..	...	....
76	*Etheostoma eos* Jordan & Copeland	1	...	..	..	....	....
	COTTIDÆ.						
77	*Cottus richardsoni* Agassiz	....	..	2	2	...	5
	Number of species in each stream	41	57	38	30	33	16

The following species were found common to all the streams seined:

Catostomus teres Mitch.
Catostomus nigricans Le S.
Campostoma anomalum (Raf.).
Notropis megalops Raf.
Ericymba buccata Cope.
Pimephales notatus (Raf.).
Hybopsis kentuckiensis Raf.
Etheostoma cœruleum Storer.
Etheostoma nigrum Raf.—9 species.

The following were found in but one stream:

In the Tippecanoe River:

Noturus exilis Nelson.
Ameiurus nebulosus Le S.
Placopharynx carinatus Cope.
Lagochila lacera Jor. & Brayt.
Hiodon tergisus Le S.
Lepomis pallidus (Mitch.).
Etheostoma scierum (Swain.).
Etheostoma camurum Cope.
Etheostoma eos Jordan & Copeland.—9 species.

In the Wabash River:

Petromyzon concolor (Kirt.).
Polyodon spathula (Walb.).
Scaphirhynchus platyrhynchus Raf.
Ameiurus nigricans Le S.
Ictiobus cyprinella Cuv. & Val.
Ictiobus urus Agassiz.
Ictiobus bubalus (Raf.).
Cliola vigilax B. & G.
Notropis boöps Gilbert.
Notropis deliciosus Girard.
Hybopsis hyostomus Gilbert.
Clupea chrysochloris (Raf.).
Dorosoma cepedianum (Le S.).
Pomoxys sparoides Lac.
Etheostoma pellucidum clarum J. & M.
Etheostoma copelandi Jor.
Etheostoma shumardi (Girard).
Etheostoma phoxocephalum Nels.
Etheostoma jessiæ Jor. & Brayt.—19 species.

In Deer Creek:

Moxostoma crassilabre Cope.
Notemigonus chrysoleucus (Mitch.)—2 species.

In Honey Creek:

Chrosomus erythrogaster Ag.
Rhinichthys atronasus (Mitch.)—2 species.

NOTE.—In a paper published in the Hoosier Naturalist, 1887, on Fishes of Vigo County, Ind., by O. P. Jenkins, the following were given from the Wabash at that point, which we did not obtain:

1. *Acipenser rubicundus* Le Sueur.
2. *Lepisosteus platystomus.*
3. *Amia calva* Lin.
4. *Leptops olivaris* Lin.
5. *Ictiobus difformis* Cope.
6. *Cycleptus elongatus* Le Sueur.
7. *Pomoxis annularis* Raf.
8. *Morone interrupta* Gill.
9. *Aplodinotus grunniens* Raf.

LIST OF FISHES FOUND IN LAKE MAXINKUCKEE.

The outlet of Lake Maxinkuckee is a small winding stream which empties into the Tippecanoe River a short distance below the Logansport and Terre Haute Railroad Bridge. The distance of the mouth of this stream from its origin is about 3 miles on a straight line, but by its windings about 9 miles. At the present time a high dam on the stream effectually prevents the passage of fish to the lake from the river. Residents in the vicinity state that before the dam was built many fishes not now found in the lake, but known in the river, were abundant in the lake. The waters of the lake are clear and cold, being fed in part by small streams, but also by many strong springs in the bottom of the lake. This lake is about 2 miles long by 1 wide. It has recently been sounded and found to be in one part 76 feet deep.

The following fishes were obtained from the lake during the month of August, 1886, by O. P. Jenkins:

1. Lepisosteus osseus. One specimen obtained by Dr. Scovell in 1887; one seen by Professor Evermann.
2. Amia calva. Common.
3. Ameiurus melas. Common.
4. Ameiurus natalis. One specimen.
5. Pimephales notatus. Common.
6. Notropis heterodon. One specimen by Dr. Scovell.
7. Semotilus atromaculatus. Common.
8. Fundulus diaphanus menona. Very abundant.
9. Labidesthes sicculus. Common.
10. Lepomis cyanellus. Very common.
11. Lepomis megalotis. Obtained by Dr. Scovell.
12. Lepomis pallidus. Common. One specimen was obtained which was 11 inches to the base of the caudal fin.
13. Micropterus salmoides. Abundant.
14. Micropterus dolomieu. Common.
15. Perca flavescens. Abundant.
16. Ambloplites rupestris. Abundant.
17. Etheostoma nigrum. Common.
18. Etheostoma eos. Several specimens.

NOTE.—In other lakes tributary to the Upper Wabash the following have been reported by Dr. Jordan in the Proc. Acad. Nat. Sci., Phila., 1877, pp. 53, 67:

Zygonectes dispar Agassiz.
Etheostoma caprodes zebra Agassiz=*Percina manitou* Jord.

SOUTHEASTERN INDIANA.

I.—FOURTEEN-MILE CREEK, CLARKE COUNTY.

The following fishes were obtained from Fourteen-mile Creek, Clarke County, by Professor Jenkins, in August, 1887:

1. Notropis megalops.
2. Noturus miurus.
3. Notropis lythrurus.
4. Notropis whipplei.
5. Notropis rubrifrons.
6. Notropis atherinoides.
7. Campostoma anomalum.
8. Pimephales notatus.
9. Ericymba buccata.
10. Semotilus atromaculatus.
11. Micropterus dolomieu.
12. Micropterus salmoides.
13. Ambloplites rupestris.
14. Pomoxis sparoides.
15. Pomoxis annularis.
16. Moxastoma duquesnei.
17. Catostomus nigricans.
18. Dorosoma cepedianum.
19. Zygonectes notates.
20. Lepomis cyanellus.
21. Lepomis megalotis.
22. Etheostoma blennioides.
23. Etheostoma caprodes.
24. Etheostoma cœruleum
25. Etheostoma nigrum.

II.—LAUGHERY CREEK, OHIO COUNTY.

The following were obtained by Professor Jenkins in Laughery Creek, near Milton, in August, 1887:

1. Noturus flavus.
2. Noturus miurus.
3. Ictalurus punctatus.
4. Ameiurus natalis.
5. Leptops olivaris.
6. Notropis whipplei.
7. Notropis lythrurus.
8. Campostoma anomalum.
9. Semotilus atromaculatus
10. Pimephales notatus.
11. Ericymba buccata.
12. Micropterus dolomieu.
13. Micropterus salmoides.
14. Ictiobus velifer.
15. Moxostoma duquesnei.
16. Catostomus nigricans.
17. Lepomis cyanellus.
18. Lepomis megalotis.
19. Dorosoma cepedianum.
20. Etheostoma blennioides.
21. Etheostoma flabellare.
22. Etheostoma nigrum.
23. Etheostoma cœruleum.
24. Etheostoma asprellus.

One specimen of this last was given me by Dr. T. E. Alden, who obtained it at Rising Sun. This is the first record of *Etheostoma asprellus* Jordan, in the State. The species was described first in the Bull. Ill. Lab. Nat. Hist. as *Pleurolepis asprellus*, sp. n. In this account it is stated that numerous specimens were in the Illinois State collection from the Little Wabash, in Effingham County, Ill., and two from Hancock County, Ill.

A specimen is in the National Museum from Alabama (Jordan).

Jordan & Gilbert obtained three specimens from the Washita River at Arkadelphia, Ark., in 1884. (Proc. Nat. Mus., 1886, p. 12.) These are the only records of its occurrence thus far.

As this specimen differs somewhat from the descriptions given, the following points are noted: Length of body to base of caudal fin, 4 inches. Head, 4.56 in length. Depth, 8 in length. Dorsal fin, XIV–15.

Anal, I–14. Lateral line, 100. Coloration, pale, with four dark bands meeting over back; the first three, in width, equal to depth of body; fourth, narrower, all extending somewhat obliquely forward to lateral line. First band beginning on head and extending to first dorsal; second, beginning at middle of first dorsal, extending to second dorsal; third. beginning at middle of second dorsal and extending to a little past second dorsal; fourth, on caudal peduncle to caudal fin. A dark streak along lateral line; darker as it passes through the dark bands.

(*Pleurolepis asprellus* Jordan, Bull. Ill. Lab. Nat. Hist., 2, p. 38, 1878.
Pleurolepis asprellus Jordan, Manual Vert., ed. 2, 404.
Ammocrypta asprella Jordan & Gilbert, Synop. Fishes, N. A., p. 490.
Crystallaria asprella Jordan & Gilbert, Proc. U. S. Nat. Mus., 1886, p. 12.
Crystallaria asprella Jordan, Cat. Fishes N. A., 1885, p. 78.)

III.—FRANKLIN COUNTY.

In Bulletin No. 2 of the Brookville Society of Natural History, Mr. Evermann published "A List of the Fishes observed in the Vicinity of Brookville, Franklin County, Indiana."

This list, printed in March, 1886, contained thirty-five species. About the 20th of May following a little time was spent by W. P. Shannon and O. P. Jenkins seining Little Salt Creek, in the northwestern part of the county, which enables us to add the following nine species to the list:

1. Catostomus teres Mitchill.
2. Chrosomus erythrogaster Agassiz.
3. Hybognathus nuchalis Agassiz.
4. Notropis whipplei Girard.
5. Notropis lythrurus Jordan.
6. Notropis atherinoides (Raf.).
7. Ericymba buccata Cope.
8. Rhinichthys atronasus (Mitchill).
9. Semotilus atromaculatus (Mitchill).

IV.—OCCURRENCE OF THE BROOK STICKLEBACK (EUCALIA INCONSTANS KIRT.) IN THE OHIO BASIN.

Jordan & Gilbert give *Eucalia inconstans* as ranging from "New York to Kansas and Greenland, in fresh waters only; abundant in the Great Lake region." So far as we are able to learn it has never been reported from the Ohio Valley until now. To W. P. Shannon, of Greensburgh, Ind., belongs the credit of its discovery in this region.

In a "List of the Fishes of Decatur County, Indiana," recently printed privately by Mr. Shannon, he reports that he took about twenty specimens in some ponds which were tributary to Clifty and Flat Rock Creeks, which flow through that county. These were obtained in June, 1887. Specimens of this fish have been introduced into Clear Creek, in the State University campus at Bloomington, from Cayuga Lake, New York.

The following species are here reported for the first time from Indiana:

Lagochila lacera Jor. & Brayt.
Etheostoma pellucidum clarum Jor. & Meek.
Notropis arge (Cope).
Etheostoma jessiæ Jor. & Brayt.
Etheostoma asprellus Jordan.

ON THE OCCURRENCE OF THE GREAT LAKE TROUT (SALVELINUS NAMAYCUSH) IN THE WATERS OF BRITISH COLUMBIA.

BY DAVID S. JORDAN.

I have lately received from my friend, Mr. Ashdown H. Green, of Victoria, British Columbia, the heads and fins of two large specimens of the Great Lake Trout (*Salvelinus namaycush* Walbaum). One of these specimens has been sent to the U. S. National Museum, where it is numbered 39343, the other is in the collection of the Indiana University. The specimens are not evidently different from the ordinary Lake Trout. They are very dark in color, the gray spots on the tail are very distinct, and the caudal fin is rather more deeply forked than usual in specimens so large. The following is from Mr. Green's letter in regard to them:

"The trout came from Canim Lake, about 20 miles east of the hundred-mile post on the Caribou wagon road. The same fish is, I am informed, found in Lac la Hache on the wagon road and perhaps in most of the large lakes of British Columbia. My attention was first called to it by hearing of a forked-tail Trout very different from *S. purpuratus* or *S. malma*. The forked tail decided me to send an Indian to Canim Lake for specimens. He brought me two, but had unfortunately cleaned them so that I was unable to examine or to preserve the stomach and appendages. Having no means of preserving such large fish I pressed my bean-pot and all my whisky into the service and brought the heads to Victoria. The fish were in good condition, and nearly black, though very much spotted with light gray." These specimens considerably extend the range of *Salvelinus namaycush*. The authentic record farthest westward is that of its occurrence in lakes on the northern boundary of Montana, tributary to the Upper Missouri. It occurs, however, in the waters of Alaska.

Mr. Green also reports the capture of *Salvelinus malma* east of the Rocky Mountains in the South Saskatchawan.

He also mentions the capture of a basket-full of Capelins (*Mallotus villosus*) at Victoria. This species has never before been noticed so far south in the Pacific. It is new to the fishermen of Victoria.

INDIANA UNIVERSITY, *November* 29, 1887.

(Proceedings U. S. National Museum, Vol. XI, 1888.)

THE NAVAJO TANNER.

BY DR. R. W. SHUFELDT, U. S. A.

(With Plates XXIII–XXVIII.)

During the summer of 1887, and at a time when the writer was stationed at Fort Wingate, N. Mex., he received a letter from his friend Prof. Otis T. Mason, Curator of the Department of Ethnology of the National Museum, informing him of the fact that there was on record no special account, so far as he was aware, describing the manner in which the North American Indians tan and prepare their buckskin.

As is well known, all of our Indians, from time immemorial, have skillfully manufactured this material and put it to an infinite number of uses to meet the necessities of the life they lead. So Professor Mason was thus prompted to contribute to this branch of our literature of the subject, and did me the honor of asking me to render an account of the process as it is practiced among the Navajoes, a tribe of Indians of which many are found living in the valleys and among the mountains about Fort Wingate.

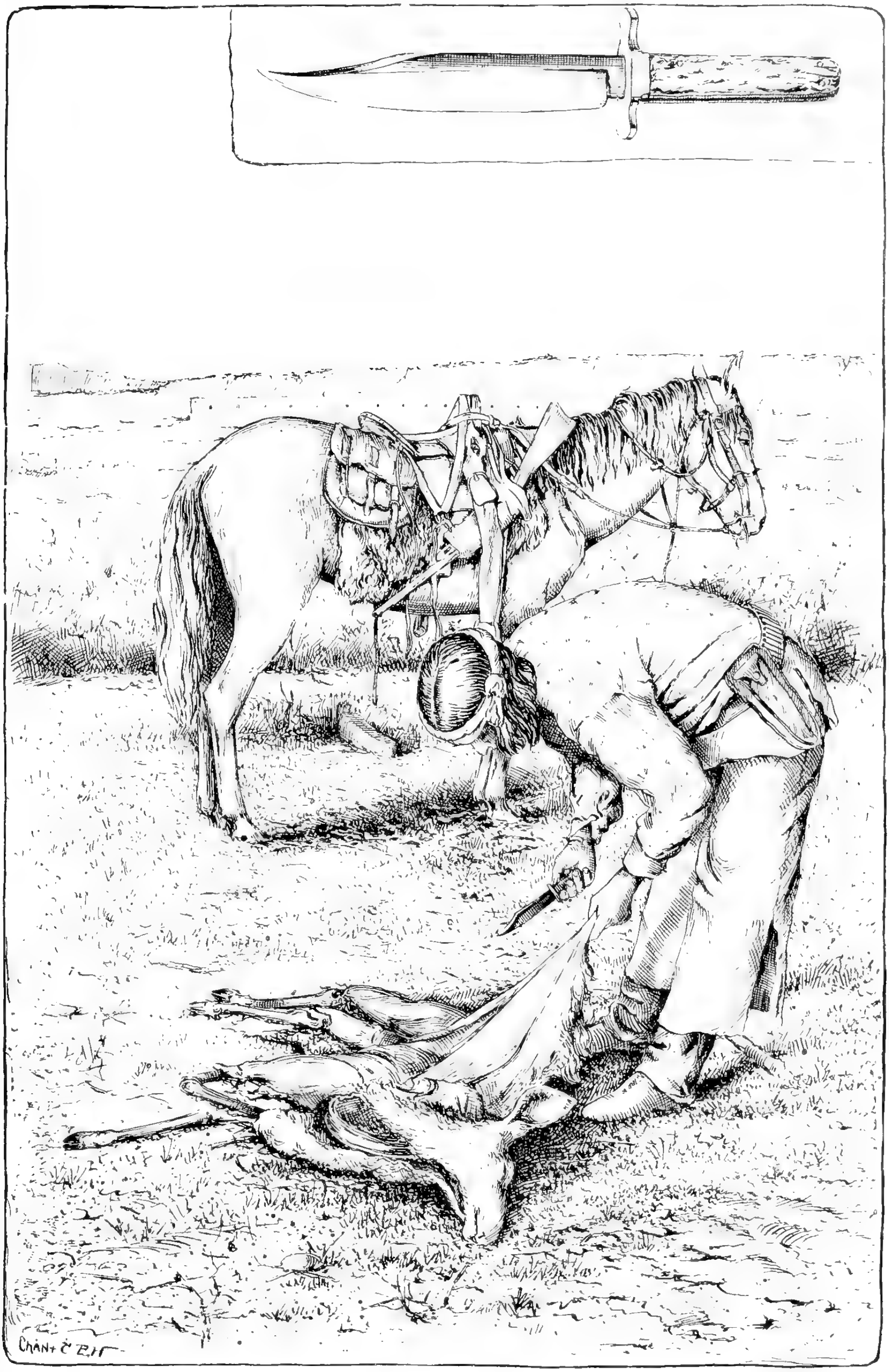
Circumstances soon admitted of my undertaking this matter, and a Navajo hunter was dispatched to bring in a deer, for the purpose of preparing its hide directly under my personal observation, and thus allowing me to record carefully each step of the operation.

In a day or two this Indian returned with a fine doe, an adult specimen of *Cariacus macrotis*. He had skinned the legs of the animal from the hoofs up as far as the ankles, which he disarticulated partially, so the limbs could be tied more compactly together, and thus be less liable to either frighten his horse or catch in the low timber as he returned home with his game. Strange to say, this was the hardest part of my task to undertake, for the Navajo Indians have a belief that when one of them kills a deer for the purpose of tanning its skin, to make buckskin, the hide must be removed on the spot where the animal was slain, or else the successful hunter will lose his eyesight before the next moon.

I had great difficulty in finding a Navajo that had sufficiently little faith in this superstition to be overcome by a generous reward for his pains. The deer which had been captured for me had already been eviscerated and the skin divided from its chin to its tail—the entire length of the under side of the animal. He threw it down upon the ground in front of his lodge, and, as I had my camera with me, prepared for the emergency, I directed him to commence operations at once. In a moment, with a sharp hunting-knife, he divided the skin on the inside

of the thighs, from the ankles to the abdominal division, making similar incisions on the inside of the fore-limbs. The legs were quickly skinned, the small tail split up on its under side and the vertebræ removed, while with his knife the hide was started on both sides from the abdominal and throat incision and quickly removed in the direction of the animal's back. Thus it was that the skin was removed from the entire body and up to the ears first; then as he arrived at these latter, their cartilages were cut through close to the skull, leaving the great ears of this species of deer attached to the hide. When he arrived at the eyes, these were skinned round, much in the same way as a skillful taxidermist manages the eyes in any vertebrate specimen he may be preparing. Upon arriving at the muzzle he simply divided the skin all around, posterior to the external nostrils, and the operation of removing the hide was completed. During the time he was engaged in skinning the sides towards the back I succeeded in making a successful photograph of him in the act. It forms one of the illustrations of this paper. He next proceeded to dig a hole in the ground (with a spade that stood near) of a capacity about as big as a bushel. The bottom of this excavation was tramped hard with his feet and the hide placed therein, hair side up, and immediately covered entirely over with cold water from a neighboring spring. On top of the hide he placed a camp-kettle, bottom side up, and braced it down with the spade. This was to prevent the skin from drying and the kettle to keep the ravenous Indian dogs from eating it up during the night.

He now informed me that was all that was to be done to it at present, and he would not touch it until I arrived there again in the morning. Bright and early I was upon the ground, and he left camp with an ax to soon return with the trunk of a small pine tree which he had cut down in the mean time. At its thickest end it was about 6 inches through, and about 4 at the smaller extremity. From one side of the larger half he removed the bark, completely exposing the smooth surface of the wood beneath it. He next cut a deep notch in the big end of this stick, so as to assist in bracing it against the limb of a small cedar tree near by, with smooth surface facing him and the small end of the stick resting firmly upon the ground some 2 feet from the base of the aforesaid cedar tree. Around about was plentifully bestrewn some clean, short hay, to prevent the hide from being soiled upon the ground beneath. We now returned to the hole where the skin had remained over night, and it was taken out to be washed in clean water, when he proceeded with a sharp knife to remove all superfluous tissue from its raw side, skinned the ears carefully by removing completely the cartilaginous parts, then cleared away the muscles which had remained attached about their bases, trimmed off the remains of the *panniculus* muscle, and indeed left nothing but a thoroughly clean hide, which received its final dip in clean water.



1. NAVAJO INDIAN SKINNING DEER. (Page 59.)

It was now ready to have the hair shaved from it, and it was interesting to see how the parts of the animal are converted into instruments to be used again in converting other of its parts into material to supply the wants of the Indian. This seems to obtain in all of the simple manufactures of the aborigines, and deer are slain with arrows, the heads of which are attached to the shaft with sinews from the body of one of their own species; indeed, the hunter himself may be clothed in buckskin. My tanner obtained his scrapers from the bones of the fore-limb of the deer he had killed, and the ulna and radius of this limb are wonderfully well-fitted to perform the work of this natural spokeshave. These bones, as we know, are in a deer, as in many other hoofed animals, quite firmly united together, having a form well known to the comparative osteologist. The shaft of the ulna, which is closely approximated to the shaft of the radius, has its posterior edge thin and sharp, which is still further improved by the tanner scraping it with his knife. The olecranon process, with the deep sigmoid notch, forms an excellent handle at one end, while the enlarged distal end of the radius, with the carpal bones, which are usually left attached, forms a good one at the other. Moreover, the curvature of the shafts of this consolidated bone is favorable for the use of our Indian tanner, who, in using this primitive instrument, seizes it at either end in his hands, and works with it in shaving off the hair much in the same manner as one of our carpenters uses a spokeshave, only here the sharp edge of the ulna bone takes the place of the knife edge in doing its special work. (See plate.)

Before proceeding further, I should mention that after removing the hide, on the first day, he placed the skinned head of the deer, without the lower jaw, in the ashes of a low camp-fire, where the brains were able to become semi-baked during the first night, as these parts, too, are utilized in the tanning process.

Next to shaving off the hair, the hide is thrown over the small log he had arranged against the tree in the morning, being held in place by catching the skin of the head between the notch and the limb, the skin of the hinder parts being always nearest the ground, and as the work proceeds it is deftly shifted about by the tanner.

Now all the hair except on the lower parts of the legs and the tail, is rapidly scraped off with these bone scrapers, including the black epidermis.

Some tanners use a deer's rib, or a beef's rib, and others a dull hunting-knife, but the bones of the deer's forearm is the usual instrument, and it is quite remarkable to observe how handily it is managed, and how rarely a hole is cut in the skin. The shaving is carried to the very edges of the hide all around, and even the backs of the ears are carefully scraped, the entire operation lasting from two to four hours, depending upon the size of the deer. After my Navajo had got well started into this part of his work, I was successful in obtaining a good

photograph of him, a copy of which is herewith presented in fig. 2 (see plate), showing him in the act of drawing down his scraper.

In appearance the hide now has the same form as when removed from the animal; the hair side is clean and white, the body side devoid of all superfluous tissue, the backs of the ears still showing the black epidermal layer of the skin, as it is only from these parts where it is not scraped off with the hair; the hair also is left on the skin of the lower halves of the four limbs.

A thorough washing is now given it in several changes of clear, cold water, though sometimes in the last wash the water may be made slightly tepid, and in this it is allowed to stand while the tanner prepares the brains of the animal soon to be used in another stage of his work.

Picking up the deer's skull from the ashes where he had left it the night before, he took an ax and split it along the bifrontal suture, cleaving the skull partly in two; then chipping off the parietal bones he was enabled to lift out the brains nearly entire. They were at once transferred to a basin of tepid water, where by gentle manipulation the little slivers of bone (which had gotten into it while splitting the cranium), the blood, etc., were effectually removed. Next they were placed in a small quantity of tepid water in another basin and put upon a low fire, where they were allowed to simmer for over an hour. At the end of this time the water then being not so hot but that one could comfortably hold his hand in it, had come to be of a muddy color, and our tanner, using the fingers of one hand as a sieve, lifted out from the water the little particles of brain in a small pile upon the palm of his opposite hand; then, by rubbing this together between the palms of his hands, it was soon reduced to a pasty mass. This process was continued until all the brains were thus reduced and dissolved, and then the water in which they were had about three times its quantity of clear tepid water added to it, nearly filling the small basin. The fluid had every appearance of, and quite agreed in consistency with, a big bowl of ordinary bean soup, and it was now ready for use, being left just near enough to the camp-fire to keep it warm, and no more.

Returning to the skin, it was now removed from the water where it had been left, carefully rinsed, and wrung out with the hands in a manner much as we see washerwomen wring out clothes, and carried over to the tree where the scraping process had been done. Here the tanner selected a small limb, about 5 or 6 feet from the ground, and passed the head and neck of the hide under and over it, and then carefully folded this latter part lengthwise along the middle of the body surface of the hide, and twisted the whole over and over till he came to the fore-legs. It will be seen that the limb was firmly infolded within a loop of the hide, and by pulling heavily upon it I saw that there was no such thing as its slipping. In a similar manner the skin of the forelegs was folded lengthwise inside the hide; then the borders of the abdominal in-

2. NAVAJO INDIAN REMOVING HAIR FROM DEERSKIN. (Page 62.)

3. NAVAJO INDIAN WRINGING THE WATER FROM A DEERSKIN. (Page 63.)

cision were likewise folded in; and in turn the skin of the hind legs, but this latter had, of course, to be thrown in, in the direction of the tree, so as to include them. The borders of the hinder parts were thrown over a stick in such a way as to form a loop, like the one around the limb of the tree. During all this operation the hide was being twisted from left to right, and at its completion looked like a wet hide rope, fast, as we have described, to the tree at one end, and looped over a stick about 2 feet long at its middle, at the other. This latter was used as a twister by the tanner, for now he proceeded to wring the hide thoroughly by twisting it over in one direction, causing the water to be rapidly squeezed out of it. While he was in this position I obtained an excellent picture of him, which is shown in fig. 4 (see plate).

By the continuance of this twisting the skin was finally brought up close to the limb of the tree in a hard coil, where, by hooking the turning stick under the limb, it was held in that position, and allowed to drip for nearly an hour. If any of my readers should ever chance to see a deer hide thus coiled up in a tree, glistening and wet, I am quite sure they will agree with me in saying, that for all the world it looks like a few knuckles of small intestines of a man immediately after removal.

At the end of the above-mentioned time the Indian unhooked the stick, untwisted the hide, and took it down. It had apparently shrunk two-thirds of its size, and looked like a damp, semi-tanned dog-skin more than anything else I can compare it to; and the tanner immediately set to work to pull it into shape, as he walked in the direction of his camp-fire.

Spreading out a small buffalo-robe he sat down upon it, and proceeded to pull the hide vigorously with his hands in every direction. Catching hold with his fingers of the extreme edges, he tugged away at it until it was nearly its original size. I noticed, however, that he only employed his hands in this part of the operation, and never once resorted to his feet for assistance in the stretching. After he was satisfied that the entire surface of the hide was opened and exposed again, he carefully spread it out perfectly flat, with hair side up, upon the buffalo-robe on which he had been sitting.

Then taking his basinful of dissolved deer brains, he commenced applying it with his hand to the surface from which the hair had been removed. It is never put on the opposite side of the skin. In doing this he frequently rubbed the solution well in, using his open hand for the purpose, and as he came to the head, ears, and legs he worked the stuff in with his fingers, and occasionally kneaded it with his knuckles, going over the entire skin on the side referred to, until his basin of brains was expended, and the whole had been worked in as described.

Upon asking him why he only put it on the hair side, he gave me to understand that the pores were on that side and consequently the brains could get into the skin more effectually; and upon inquiring why

he put them on at all, he said "to make it soft." Buckskin that is tanned without using brains is harsh and stiff afterwards, and still worse in these particulars if it happens to get wet at any time.

The Navajoes often use beef brains too for this purpose, especially when their game is taken far from camp, and they do not care to pack the deer skulls home on their ponies. In early days they employed deer brains as a rule, but in some cases the brains of the buffalo, when that animal existed in their country.

While he was in the midst of the process of applying the brains to the hide, with an August sun of no mean power streaming down upon us, I made an instantaneous exposure of him with my camera, and succeeded in obtaining an excellent picture showing this stage of the tanning process, which picture is reproduced for the present paper.

Finally, as the last step of the process, he commenced by folding in the edges of the skin all round continuously, to make it up into an ellipsoidal ball, quite firm, though not tightly rolled. He then wrapped it up in the buffalo robe, and allowed it to remain out in the sun for about fifteen minutes for the purpose, he said, of letting "the brains go well into him."

Once more in its wet and limp condition it is thoroughly opened, and this time spread out over the top of a sage-bush near by with the outer surface exposed to the sun, and sufficiently high from the ground to prevent the dogs from getting at it, or its being soiled through accident. It was now about 3 o'clock in the afternoon, and very warm, the semi-tropical sun doing its full duty, and the skin at once commenced to show the effects of it as the first stages of drying set in. Nevertheless I was informed that the hide would now be allowed to remain there and dry until dark, when it would be placed upon top of the "hogan" for the night, or in the event it rained, be taken in and hung up inside.

Next morning I was on the ground at 9 o'clock, and was thoroughly surprised at the appearance of the hide when it was brought out and shown me. Although I was familiar with the making of buckskin, not only as practiced by the Navajoes, but by the Sioux and other North American Indians, I never happened to have seen it in this particular stage, that is, right after the drying on the second day.

I found that it had again shrunken so as to be not more than one-third of its original size, or just after it had been removed from the animal. It was hard, and appeared almost brittle, as though it might be broken in two; moreover it was semi-transparent, and easily transmitted the light through it, or even prominent objects might be outlined through it in favorable lights. In color it was of a deep, muddy amber, or a semi-translucent Roman ocher, and one would never have suspected in the world that it was either a deer hide, or much less that in a few short hours it could be converted into the softest and most durable fabric in the country—a tanned buckskin.

4. NAVAJO INDIAN PULLING DEERSKIN INTO SHAPE AFTER WRINGING. (Page 63.)

By the exercise of considerable ingenuity and careful bending he now forced the skin into a large camp-kettle containing clear water, from which the chill had been taken off by the addition of a very little warm water, and in this it was allowed to soak well for the next three hours, standing during all this time out in the morning sun.

Some of the Indians insist that this soaking should be done in absolutely cold water (spring water), and a New Mexican guide who has been among the Navajoes for many years, being an excellent tanner himself, claims that it is almost the universal practice, *i. e.*, to soak it in cold water on the morning of the third day instead of in tepid water. However, there was but little difference, for on the present occasion the water was almost cold from the start, and quite so after the skin had been in it twenty minutes. This washing the Indians tell me is to remove all traces of the brains which were rubbed into the skin the day before.

He next gives it three or four thorough rinsings in clear, cold water, and takes it over to the tree to wring it. This is done precisely in the manner already described above and shown in fig. 4. Likewise it is curled once more, made into a coil, twisted and retwisted upon itself, and allowed to drip in this condition for nearly half an hour. It is then once more undone and drawn out into shape, as on a previous occasion, after wringing.

He is very careful now in exposing the entire surface; pulling out the edges, stretching the skin of the ears, flattening out the skin that covered the legs, and paying similar attention even to the little tail.

In the mean time he had brought a large, square piece of canvas and spread it out upon the ground near where he was at work. It is upon this that the last stages of the operation will be performed. Bringing next a sharp knife, it takes him but a moment to whittle out from a piece of soft pine an instrument that resembled a large wooden awl. This with the knife he threw upon the canvas sheet, where they may distinctly be seen in fig. 6. To return to our hide; how different it looks after this second wringing than it did after the first one it received. Now it looks as though he might make something out of it, but he still persists in pulling away at the edges all round, over and over again, until the whole is manipulated into a shape to suit him. Even this primary handling now has its effect, and in some places the skin begins to grow like buckskin. At last he sits down on the middle of the canvas sheet, having first thrown aside his hat and removed his moccasins. He wears nothing but his thin Navajo shirt and trousers, while beside him is his wooden awl and sharp knife.

The picture is by no means an unpleasing one, for throughout the entire piece of work this Indian has been tidy to a degree most scrupulous, and as he sat in the broiling sun upon the broad sheet of canvas he formed an excellent subject for the artist. All I could do was with the camera just then, and in a twinkling it was transferred to a plate. (See fig. 6.)

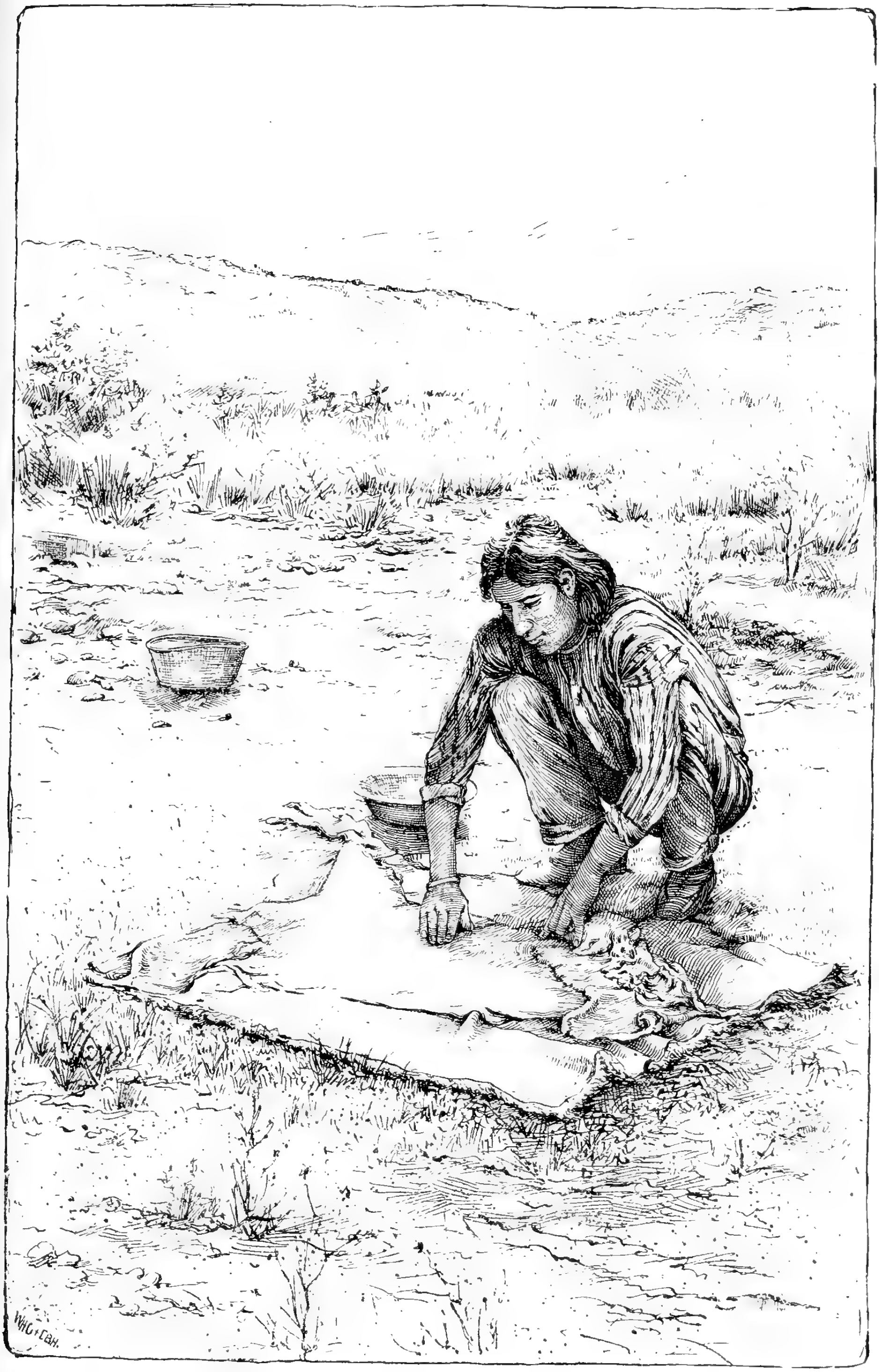
Apr. 8, 1888.

Soon I found myself stretched out upon the hot and naked turf of the prairie near him, and then a long-practiced habit of his ancestors showed itself, for as he proceeded with his work one might hear him humming in a low tone to himself one of the songs of his native tongue. He threw the now limp skin lengthwise over his naked feet and pulled it with both hands in the direction of his body. Rapidly repeating this operation, he turned it and tugged at it the other way. But it was most often thrown over his feet and vigorously pulled towards him. Then he stretched it out with his hands, pulled it this way and then pulled it that, worked at the edges to get them limp and pliant, manipulated the ears and the skin of the legs. But during all this an interesting change was coming over it, the heat of an August sun was rapidly drying it, it was fast coming to be of a velvet-like softness throughout, and, attaining its original size, it was changing to a uniform pale clay color. The hair side was smooth, while the inside was roughish. Indeed, in a few moments more, it was buckskin.

Picking up next his wooden awl he commenced far forward on the extreme edge of the skin of the neck of the right side, and by successively stretching it over the handle of the awl, cut upon this edge some dozen or thirteen holes with his knife. Then beginning in front, he put the awl in every hole, and by holding on to the edge of the opposite side with his left hand he was enabled to powerfully stretch the skin of the neck transversely. This operation is shown in fig. 7. His mark must go on next, so turning the skin of the head over he cut on either side just below the ear on the body or inner surface of the skin a leaf-like figure with the apex pointing forwards and outwards.

This was the last touch of all, and the now finished fabric, if we may call it a fabric, so pliant, so soft, and withal so very useful, was spread out on the canvas for an hour in the sun to receive its final drying, after which it passed into my possession, or rather into the possession of the National Museum to which it really belonged. One of these finished skins retains much the same form as the hide had when first removed, though it may be rather larger from the stretching. The backs of the ears are always black; the edges all around are uneven and harder than the rest of the skin; the hair remains upon the distal moieties of the skin of the legs; bullet holes of entrance and exit will usually be seen, or they may be an accidental rent or two of small size.

The Navajoes value these hides at a price varying from $1.50 to $2, depending upon the size, and the need they stand in of the money. Squaws, I am told, never engage in manufacturing them, while the Indian boys learn the art at a very early age.



5. NAVAJO INDIAN APPLYING BRAINS TO DEERSKIN TO MAKE IT SOFT. (Page 63.)

6. NAVAJO INDIAN FINISHING DEERSKIN BY STRETCHING IT. (Page 65.)

NOTE ON THE GENUS DIPTERODON.

BY THEODORE GILL.

In 1802, Compte de Lacépède proposed (Hist. Nat. des Poissons, t. 4, p. 165) a genus called *Dipterodon* for six species of spinous-finned fishes belonging to the genera now generally known as *Lutjanus*, *Apogon*, *Aspro*, and *Sciæna*. The only characters assigned were the development of two dorsal fins and the possession of teeth in the jaws. The absolutely worthless character of such a combination will be generally recognized from the names of the constituents.

In 1829, Cuvier, in the second edition of Le Règne Animal (t. 2, p. 194) used Lacépède's name *Dipterodon* for a genus of which only a single species was known; that species was a recently discovered one, *D. capensis*, of the Cape of Good Hope; was unknown to Lacépède, and had no relation to any of the species known to him, as Cuvier, in fact, recognized. He remarked that this genus, whose name is taken from Lacépède, does not comprise the same species. Such a system of nomenclature is now universally discarded, and consequently the name *Dipterodon* can not be used in the sense in which it was employed by Cuvier.

During his life-time, Gronovius had obtained the fish subsequently described by Cuvier from the Cape of Good Hope, and had given it in manuscript the name of *Coracinus*. The Gronovian manuscript, however, was not printed until 1854, when it was published under the auspices of Dr. John E. Gray, into whose hands it had in due course come, and of course the new names can only date from that time.

No other names having been given to the genus *Dipterodon* of Cuvier, the Gronovian name of *Coracinus* would have been in place, as Professor Jordan subsequently proposed. Professor Jordan in 1883, in the Proceedings of the U. S. National Museum (vol. 5, p. 573), remarked that "the name *Dipterodon* has been used by Cuv. and Val. for a genus unknown to Lacépède. This transfer of the name is not allowable, and the *Dipterodon* of C. and V. should receive a different name, that of *Coracinus* Gronov. (1854.)"

Unfortunately, however, the use of the Gronovian name, as proposed by Professor Jordan, is precluded by a previous employment of that name in another connection.

In 1831, Pallas, in his Zoographia Rosso-Asiatica (vol. 3, p. 255), had proposed a genus distinguished, as he supposed, by the sheath for the spinous dorsal fin, which he called *Coracinus*, referring to it two species living in the Black Sea, the *C. chalcis* and the *C. boops*. These species,

as is now generally recognized, are two well-known fishes occurring in the Mediterranean and the seas of Europe generally, the *C. chalcis* being the *Corvina nigra* of Cuvier, and the *C. boops* of Pallas being the *Umbrina vulgaris* of Cuvier.

The names *Dipterodon* and *Coracinus* having been both used previously, and consequently inallowable for another genus, and no other name having been given to the South African fish, a new designation must therefore be supplied. *Dichistius* is proposed as being applicable. The relations of this fish have to be ascertained by study of the anatomy, materials for which are not yet available in Washington. It does not appear to be closely related to *Pimelepterus*, as generally supposed.

NOTE ON THE GENUS GOBIOMORUS.

BY THEODORE GILL.

In 1800 Compte de Lacépède, in his Histoire Naturelle des Poissons (vol. 2, p. 583), proposed a genus under the name *Gobiomorus* for four species of fishes. The genus was simply defined as having the ventral fins not united, two dorsal fins, the head small, the eyes approximated, and the opercula attached for the great part of their margin. The species referred to it belong to the four genera—*Nomeus*, *Valenciennea*, *Philypnus*, and *Periophthalmus*. These genera were distinguished in the following order:

In 1801, *Periophthalmus*, by Bloch & Schneider.
In 1817, *Nomeus*, by Cuvier.
In 1837, *Philypnus*, by Valenciennes.
In 1856, *Valenciennea*, by Bleeker.

In 1883 Professor Jordan, in the Proceedings of the U. S. National Museum (vol. 5, p. 571), has proposed to restrict the name *Gobiomorus* to *Philypnus*. He remarks of the name: "It has not as yet been restricted by any author so far as we know. It seems to us best to consider as the type of *Gobiomorus*, *G. dormitator* Lacépède, and therefore to use the name *Gobiomorus* instead of *Philypnus*. A serious practical objection to the consideration of *taiboa* (*strigatus*) as the type of *Gobiomorus* lies in the uncertainty whether this species is really congeneric with *Eleotris gyrinus* (which species must, we think, as "*Eleotris pisonis*" be considered the type of *Eleotris*). In Bleeker's systeme, *strigatus* is made the type of a distinct genus (*Valencïennea* Bleeker) and placed at a distance from *Eleotris*, but no diagnostic features of importance have been made known by which it may be distinguished."

The reasons assigned do not appear to be sufficient for a restriction of the name *Gobiomorus* to *Philypnus*. As has been already shown, *Gobiomorus* was a very heterogeneous genus, and not by itself deserving of any consideration. Of course, however, the principles of nomenclature compel us to do something with it. Inasmuch as the genera *Periophthalmus*, *Nomeus*, and *Philypnus* had already been properly constituted, there is no reason why those names should not be retained. The only species for which *Gobiomorus* could therefore be used as a generic designation is the *taiboa*. This is considered by Professor Jordan to be perhaps, if not probably, a species of *Eleotris*, the genus *Valenciennea* not being regarded as well distinguished. To the present writer, however, the genus *Valenciennea* seems to be entirely deserving of

generic differentiation from *Eleotris*, and inasmuch as the name is prior to *Valenciennea* it should be retained for it. If, however, the group is not regarded as being generically distinct from *Eleotris*, the question may arise whether its name or *Eleotris* shall be adopted. At any rate it is inadvisable, for the present at least, to apply it to the genus *Philypnus*, and that genus should retain the long honored name which it has enjoyed until its use was contested by Professor Jordan.

NOTES ON EUROPEAN MARSH-TITS WITH DESCRIPTION OF A NEW SUBSPECIES FROM NORWAY.

BY LEONHARD STEJNEGER.

To satisfactorily settle the status of the various forms of the Marsh-tits occurring in Europe will require the bringing together of a vast material from all parts of that continent, and a very careful and intelligent study of it when collected. When wading through the extensive literature one is struck with the contradictions and the confusion which meet one on every hand, and in looking into the matter one will find that it is all due to the desire of those, who try to make any distinctions at all, to refer the specimens which they happen to possess to one of two names. It is a kind of religion with them that there must be no more than two forms, or "species" of Marsh-tits in Europe. The gentlemen who believe in the distinction of *Parus palustris* and *Parus borealis* are in the majority, and they are represented in nearly all the countries of Europe. In many of these countries two species of Marsh tits occur together in the same locality, hence one must necessarily be *P. palustis* and the other *P. borealis.* In the former identification they are not likely to be mistaken, for it seems that *Parus palustris* is very uniform, both in size and coloration, all over Central and Northern Europe (exclusive of Great Britain, which has its own insular race, *P. palustris dresseri*), and their descriptions of this species agree pretty well; but when they come to point out the characters of the alleged *P. borealis* as compared with *P. palustris*, they fall into endless contradictions, because their so-called *P. borealis* are different birds in the different localities. To substantiate this assertion let us first take up Victor Fatio's account of the Marsh-tit in the Swiss Alps (as reproduced in Dresser's Birds of Europe, III, pp. 109–113), from which we gather that he considers *P. palustris* (the form which he describes as having the hood "deep, lustrous black, with blue reflections") to be smaller with a smaller and slenderer bill than *P. borealis* * (and *P. alpestris*, both of which have the hood blackish-brown with reddish-brown reflections). If, again, we turn to Degland and Gerbe's "Ornithologie Européenne" (I, p. 566), the differences are stated as above: *P. borealis* (Degl. & Gerbe's *P. palustris*) being distinguished "par une aile plus longue," and "par un bec plus fort, plus élevé, plus large à la base." Robert Collett, on the other hand, in speaking of the Marsh-tits in Norway (Nyt Mag. Naturv.,

* *P. palustris*: length of wing, 61 to 63^{mm}; length of beak from gape, 10 to 11^{mm}; from frontal plumes, 7.5 to 8^{mm}; breadth of beak, 4.5^{mm}; heighth of beak, 4^{mm}. *P. borealis* (and *alpestris*): wing, 65 to 68^{mm}; beak, from gape, 11.5 to 14.5^{mm}; from frontal plumes, 9 to 11^{mm}; breadth, 5 to 6^{mm}; height, 4.5 to 5^{mm}.

XXIII, 1877, pp. 108–110), asserts that "as a rule *P. borealis* has a somewhat slenderer bill" than *P. palustris*, and from his tables of measurements (*tom. cit.*, p. 110) it is plain that in Norway the two forms are of essentially the same size, *P. palustris* being, if anything, the larger of the two. Nilsson, too (Skand. Fauna, Fogl., 3 ed., I, p. 419), insists that both forms are of the same size, and he adds that the shape of the bill is also the same. If we now compare the measurements which I have taken myself (see tables below), it will be seen that they fully bear out the various statements of the gentlemen quoted above. It is then plain that the Scandinavian so-called *P. borealis* differs from the one of the Alps by being smaller, with a much slenderer bill. The latter form is *Parus montanus* (BALDENSTEIN, 1829)* in which name at present I am obliged to include Victor Fatio's *P. alpestris* and *P. borealis* (*nec* SELYS), as I have no means of verifying their status, though I believe them to be separable; nor do I know to which of the two forms Baldenstein's name *montanus* and Bailly's *alpestris* strictly belong.

But it is not only in size that the southern *P. montanus* differs from its northern representative, for the hood is not black at all in the former, being, as it is, of a dark sepia slightly mixed with reddish; in fact, my French specimens of *P. montanus* are quite as brown-headed as *P. lugubris*. This difference in the coloration of the hood of the southern and northern so-called *P. borealis* is also indirectly indicated in the comparisons instituted between these forms and *P. palustris* by the various authors. Thus Fatio (*loc. cit.*) strongly contrasts the "deep lustrous black with blue reflections" of the latter, against the "blackish brown with reddish brown reflections" of the former (*alpestris*: "*dark* blackish brown, with reddish brown reflections;" *borealis*: "blackish brown, a little more pronounced than in *P. alpestris*, and with reflections even still more brown"). Collett and Nilsson (*ll. cc.*), on the other hand, make no distinctions as to color, simply saying that the hood in *P. palustris* is more glossy.

The shape of the tail is the same in *P. montanus* and *P. borealis*, and on the whole they are nearer related to each other than is either of them to *P. palustris*. They are only subspecies of the same species, but whether they should be designated by trinominals is quite a different question, and depends solely upon whether they are "known now to intergrade" (A. O. U. Code, can. xi). So far as I can find out they are not known to intergrade; I consequently retain the binominal appellation.

So far we have gained the following results: In Northern Europe the true *P. borealis* occurs; in Central Europe the large and more brown-headed *P. montanus*; their habitats are widely separated and isolated. On the other hand, *P. palustris* occurs all over Europe (except in Great Britain, where it is represented by *P. palustris dresseri*), breeding even in the same localities in which *P. borealis* and *P. montanus* breed. This,

* *Parus cinereus montanus* BALDENSTEIN, Neue Alpina, II, 1829 (p. 21) nec *Parus montanus* GAMBEL, Proc. Phila. Acad., I, 1843, (p. 259), qui *Parus gambeli* RIDGW.

to my mind, is a fair proof that *P. palustris* is specifically distinct from the latter two. Mr. Seebohm, in his desire to make all the Marsh tits "varieties of one variable species" produced by the difference of climate of such an extensive range" (Brit. B. Eggs, I, pp. 478, 476), apparently overlooks this fact, for he restricts *P. borealis* to "Scandinavia and Northwest Russia," and makes no mention whatever of the so-called *P. borealis* of the Alps, while he gives the habitat of *P. palustris* as "Southwestern Europe, as far north and as far east as St. Petersburg" [60° N. L.], not mentioning with a single word its occurrence in Scandinavia, where it breeds at least as far north as 64° N. L. (Collett, Forh. Vidensk. Selsk. Christiania, 1872, p. 13.) This desire leads him to another sweeping statement, which has no better foundation. He says (*tom. cit.*, p. 478): "All these forms undoubtedly interbreed wherever their ranges meet." Now, if he had known the facts as they are in Scandinavia he would never have made such an assertion, for, as Robert Collett has already stated (Nyt Mag. Naturv., XXIII, p. 24), the two forms are in Norway absolutely distinct *without intergrading*, though both are common breeding birds south of the Trondhjemsfjord. Nor is it known that *P. palustris* and *P. montanus* interbreed habitually.

A somewhat loose expression by Mr. Seebohm (Ibis, 1879, p. 32) has evidently misled Mr. A. R. Wallace into constructing his curious "Map shewing the Distribution of *Parus palustris*" (Island Life, Map opposite p. 62). Seebohm says: "English skins are the brownest. Skins of *P. palustris*, Linn., from Italy and Asia Minor are a shade paler, and can not be distinguished from Chinese skins." Now, the facts are, that skins of *P. palustris* from elsewhere in Europe, including Scandinavia, also are "a shade paler" than British specimens (*P. p. dresseri* STEJN.), and "can not be distinguished from Chinese specimens." But on Wallace's map two "dark patches show the areas occupied by two identical varieties," one covering the main-land of Italy, the entire Balkan peninsula, and the Turkish portion of Asia Minor, while the other comprises a part of North China between Peking and the Yellow River.

It is not only in the descriptions of the northern and southern so-called *P. borealis* that authors differ; for, if we turn to the Scandinavian ornithologists, we will find some discrepancies in the characters assigned to the birds inhabiting Sweden and Norway. Collett (*loc. cit.*) makes out quite a difference in the coloration of the back of *P. palustris* and his *P. borealis* from Norway. The former, he says, has the "back grayish brown;" the latter, on the other hand, "grayish ash-blue." Holmgren (Skand. Fogl., II, p. 183), again, on comparing Swedish examples of the same species, does not observe any difference in the color of the back worth mentioning, but says that in the Swedish *P. borealis* "the secondaries have broad whitish-gray margins, which are always considerably lighter than the color of the back, this being easily seen even when the bird is flying, or when some distance off," while Collett only

remarks that the margins of the quills and tail-feathers are of the same color as, or somewhat lighter than, the back.

My specimens from Sweden and Norway show differences corresponding to the discrepancies observed in the descriptions of the above authors. The Swedish examples have the back more like true *P. palustris*, though somewhat paler, while those from Western Norway are equally dark, but more ashy; the Swedish ones have quite conspicuous whitish edgings to the secondaries, while in the Norwegian ones there is no difference between the color of the edges of the secondaries and the back. But these are not all the differences, for in the Norwegian birds the top of the head is deep black (though without gloss) against brownish black in those from Sweden, and the former have the under tail-coverts gray, like the color of the back, while in the latter these feathers are whitish, like the abdomen. In fact, these forms appear to be as distinct as any two in this group. I shall discuss the pertinency of the name *P. borealis* further on. Suffice it to say here, that I find no name applicable to the Norwegian bird, which, in honor of my friend, Prof. Robert Collett, I propose to call

Parus colletti, sp. nov.

Diagnosis.—Tail regularly and strongly rounded; top of head and nape pure black without gloss; color of back smoke-gray; outer margins of secondaries similar, scarcely lighter; under tail-coverts gray like the back. Longest tail-feathers 56^{mm}.

Habitat.—Norway (western portion only ?).

Type.—U. S. Nat. Mus., No. 113225.

According to my views, there occur, consequently, three forms of Marsh-tits in the Scandinavian peninsula, the most salient charcters of which, apart from the shape of the tail, may be contrasted as follows:

P. palustris.	*P. borealis.*	*P. colletti.*
(1) Top of head and nape bluish black;	pure black;	brownish black.
(2) Back "wood-brown" gray;	pale buffy gray;	"smoke-gray."
(3) Secondaries with margins of the same color;	margins of secondaries whitish;	margins of secondaries like the back.
(4) Under tail-coverts whitish;	whitish;	smoke-gray.

P. colletti belongs undoubtedly as a subspecies to the *P. borealis* group, as distinguished from *P. palustris*, which I consider a distinct species. Time will show whether a trinominal appellation for Collett's Marsh-tit will be necessary. The distribution of the two forms on the Scandanavian peninsula can at present only be guessed at. All that can be said now is that *P. colletti* seems to be western and *P. borealis* eastern.

A glance at the tables of measurements below, which give the data concerning the specimens examined by me, will show that the specimens of *P. borealis*, as far as the time of their collecting is given, are winter birds, while those of *P. colletti* are shot in summer. However, No. 113225 of the latter is in new autumnal plumage, which according to

analogy with other Marsh-tits should be more "rufous," as it is termed in the translation of Fatio's memoir already alluded to, if there be any seasonal change in the plumage of *P. borealis*, which is denied by Dresser. The latter author, however, seems to believe in a special summer plumage of the female (*tom. cit.*, p. 108). Upon looking over the list of specimens examined by him, at the end of his article (p. 118), I think there are reasons for suspecting that the alleged summer females represent the Norwegian form, *P. colletti*. Holmgren (*loc. cit.*, p. 182) says that the winter plumage of *P. borealis* is purer gray than the summer plumage, but this statement is so contrary to the observations of others that it can not be accepted without confirmation.

I.—*Measurements of Parus colletti.*

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Bill from nostrils.	Tarsus.	Middle toe with claw.	Remarks.
				1887.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
113226	Berg. Mus	♂ ad.	Bergen, Norway ..	June 18	65	55	8.0	17	14.5	
113225	....do	♀ ad.	....do	Aug. 22	61	57	7.5	17	14.0	Type

II.—*Measurements of Parus borealis.*

Museum and No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Bill from nostrils.	Tarsus.	Middle toe with claw.
					mm.	*mm.*	*mm.*	*mm.*	*mm.*
Am. Mus., N. Y., 223 .	Benzon	♂ ad.	Sweden	Dec. 2, 1878	63	58	8.0	16	14.0
Am. Mus., N. Y., 224 .	... do	♀ ad.	....do	Feb. 7, 1878	60	55	7.0	15	13.5
U. S. Nat., 56536	Schlüter, 545 ..	♂ ad.	....do	....	62	55	7.5	......	.....
U. S. Nat., 34144	Sundevall, 7 ...	♂ ad.	Stockholm, Sweden.	Dec. 14, 1851	63	56	7.5	16	.....
U. S. Nat., 111405	....	♂ ad.	Kolmården, Sweden.	Feb. 23, 1876	60	55	8.0	16	.....
U. S. Nat., 111404	....	♀ ad.	Östergötland, Sweden.	Dec. 8, 1875	63	58	7.5	17	14.0

III.—*Measurements of Parus montanus.*

U. S. Nat. Mus. No.	Collector.	Age.	Locality.	Date.	Wing.	Tail-feathers.	Bill from nostrils.	Tarsus.	Middle toe with claw.
					mm.	*mm.*	*mm.*	*mm.*	*mm.*
18978	Drouet	ad.	France	....	69	......	9	17.5	......
18977	....do..............	ad.	....do	....	68	59	9	......	......

IV.—*Measurements of Parus palustris.*

U. S. Nat. Mus. No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Bill from nostrils.	Tarsus.	Middle toe with claw.
					mm.	*mm.*	*mm.*	*mm.*	*mm.*
34143	Sundevall, 19......	♂ ad.	Stockholm, Sweden.	Oct. —, 1861	65	54	8.0	16.0	
103567	Tschusi	♂ ad.	Hallein, Salzburg...	Nov. 6, 1883	62	52	8.0	16.0	......
103566	....do.............	♂ ad.	....do	Oct. —, 1879	60	52	8.0	......	......
111407	....do.............	♂ ad.	....do	Sept. 18, 1886	65	55	8.0	17.0	14.5
17501	....	ad.	Hungary	....	65	55	8.0	......	......
111406	....	♂ ad.	Scania, Sweden	Dec. 11, 1876	66	56	7.5	......	......
113223	Berg. Mus...	♂ ad.	Bergen, Norway	Sept. 18, 1887	62	54	8.0	16.5	14.0
113224	....do.............	♂ ad.	....do	....do	64	52	8.0	16.5	......

HAMPE'S METHOD OF DETERMINING Cu_2O IN METALLIC COPPER.

BY FRED. P. DEWEY.

Having occasion to make a series of determinations of Cu_2O in copper in some suites of specimens in the National Museum, representing the process of refining pig copper to tough pitch metal, the Hampe* method was selected as being the best so far proposed.

The method is based upon the reaction between Cu_2O and $AgNO_3$, discovered by H. Rose,† and consists in treating the material to be analyzed with neutral solution of $AgNO_3$ in the cold for several days, when, according to Hampe, the following reaction takes place between Cu_2O and $AgNO_3$: $3Cu_2O + 6AgNO_3 + 3H_2O = 4CuO, N_2O_5\ 3H_2O + 2CuN_2O_6 + 6Ag$, whereby two-thirds of the copper is converted into an insoluble basic nitrate, and remains with the silver precipitated, while one-third goes into solution as normal nitrate. On filtering off the residue and determining the amount of copper contained in it, we can easily calculate the percentage of Cu_2O in the metal. The following series of results, calculated on Hampe's formula:

Cu_2O in Cu

No. 1.	0.136	0.140	2.542	3.862	8.209
No. 2.	0.222	0.128	2.537	3.897	7.897

showed the method to be quite satisfactory as far as the agreement of duplicates goes.

Rammelsberg‡ investigated the matter slightly and found that only 28.80 per cent. of the copper went into solution. He assigned the following somewhat unusual formula to the insoluble nitrate: $Cu_{10}N_6O_{35}$. Hampe§ has replied that Rammelsberg's investigation was too limited, being confined to a single determination, and proper precautions were not taken, while his own work was very elaborate and extended, and his deductions based upon many determinations. Rammelsberg used pure Cu_2O; Hampe used both Cu_2O|| and metallic copper containing a known amount of Cu_2O, but with the latter material the amount of Cu_2O present was so small that the unavoidable errors of determination would completely mask the difference between 28.8 per cent. and 33.33 per cent.

Since, however, in the actual use of the method for determining Cu_2O in copper there is always a large excess of uncombined copper present

* Zeit. f. Berg-, Hütten- u. Salinen-Wesen, 1873, Vol. XXI, p. 218.

† Pogg. Ann., Vol. CI, p. 513.

‡ Ber. Deutsch. Chem. Ge., 1877, p. 1780.

§ Zeit. f. Anal. Chem., Vol. XVII, p. 127.

|| Hampe's Cu_2O always contained CuO.

which might possibly affect the reaction, it seemed desirable to take up the subject for further investigation.

That the free copper influences the reaction is readily shown by the fact that the filtrate from the residue of Ag and $H_6Cu_4N_2O_{12}$ contains much nitrite of copper.

More recently Wells* in a different connection has fully established the Hampe formula as representing the reaction between pure Cu_2O and $AgNO_3$.

In all ordinary cases, such as the determination of Cu_2O in tough pitch metal, the determination of Cu_2O in the native copper of Lake Superior by Monroe,† and the test cases, using Cu containing Cu_2O, of Hampe, mentioned above, the unavoidable errors of the work are so great that it is immaterial whether the constant of solution is 28.8 or 33.33, but in the case of the series I had under investigation, where in one sample 8 per cent. of Cu_2O was found by the Hampe constant, such a difference could not be tolerated.

For the purpose of this investigation, therefore, a series of samples was prepared corresponding exactly with the material to which the method would be applied; that is, metallic copper containing Cu_2O, but containing a large amount of Cu_2O. It was necessary that the samples should contain nothing else.

A tolerably pure $CuSO_4$ was dissolved in hot water till a strong solution was obtained; it was, however, neither boiling nor saturated. This solution was cooled with agitation, and a crop of small crystals obtained. These were separated from the mother liquor, redissolved, and the operation repeated twice. The final crop of crystals gave an absolutely pure $CuSO_4$.

A solution was made of the pure crystals, and the copper precipitated by the electric current. In order to obtain the copper in suitable form, the plan used in refining copper commercially by the current was adopted. A strip of ordinary sheet copper was coated with paraffine wax, and then graphite was sprinkled on it; this prepared strip was used as the first cathode. When a thin film of copper had deposited, the strip was taken from the bath, and the film of pure copper removed, the coating of wax making this quite easy to do. The thin sheet of pure copper was then used as the cathode, and the electrolysis of the solution continued, until a suitable amount of copper had been precipitated.

In this way some 200 grams of absolutely pure copper were prepared.

This pure copper was next melted in a scorifier, in a gas muffle, and allowed to absorb O from the air. In this operation the greatest care had to be exercised to avoid contamination of the metal, especially by

* H. L. Wells and S. L. Penfield. Gerhardite and Basic Cupric Nitrates, the chemical work by the former. Am. Jr. Sci., Vol. XXX, p. 56.

† Trans. A. I. M. E., Vol. VIII, p. 414.

Fe. I am greatly indebted to Dr. H. G. Torrey, assayer of the United States Mint at New York, for making these fusions for me with such great care that only small amounts of Fe could be found in the metal after fusion.

55.853 grams of the pure metal were melted in a scorifier and allowed to absorb O until it had covered itself with the melted oxide; the resulting button, freed as much as possible from the melted oxide, weighed 45 grams.

Drillings from this button were crushed to an approximately uniform size, thoroughly mixed, marked off into squares, and samples for analysis made up by taking some from each square.

0.8318 gram were dissolved in HNO_3, converted into sulphate, and the copper precipitated by two Bunsen cells, yielding 0.8162 gram copper or 98.12 per cent.

2.0795 grams treated in this way yielded 2.0400 grams copper or 98.10 per cent. In the solution after the precipitation of the copper from the latter were found 0.00028 Fe=0.013 per cent.

2.7428 grams, determining the amount of copper going into solution, as well as that made insoluble by treatment with $AgNO_3$, yielded a total of 2.6918 grams copper=98.14 per cent.

The average of these three copper determinations is 98.12 per cent., adding to this the Fe, we have 98 135 per cent.; subtracting this from 100, we have 1.867 as the percentage of O present. 1.867 per cent. O=16.67 per cent. Cu_2O. We have therefore the composition of this material:

	Per cent.
Cu	83.317
Cu_2O	16.670
Fe	0.013
	100.000

For the Cu_2O determination absolutely pure $AgNO_3$ was dissolved in H_2O using 100 c. c. H_2O to 3 grams $AgNO_3$. The Cu containing Cu_2O was weighed out, and the cold solution added, using 200 c. c. or 6 grams $AgNO_3$ for each gram of the material. For the first few hours the mixture was repeatedly stirred, after which it was allowed to stand, with occasional stirring, for three to four days, being kept in a cool place all the time.

The residue, consisting of basic nitrate of copper and metallic silver, was filtered and thoroughly washed. It was then treated with quite dilute H_2SO_4, avoiding an excess. This dissolved the copper and, owing to its fine state of subdivision, a small portion of the silver also. The solution was filtered, evaporated, the silver precipitated by HCl, filtered again, and evaporated till fumes of H_2SO_4 were given off. The residue was taken up by H_2O, the solution filtered, and the copper pre-

cipitated by the battery, using two Bunsen cells, coupled zinc to zinc, and carbon to carbon. The following results were obtained:

	Per cent.
2.7081 grams gave 0.3507 Cu	=12.95
2.7428 grams gave 0.4355 Cu	=15.88
2.1279 grams gave 0.3106 Cu	=14.59
Average..............	14.47

Multiplying this by the Hampe constant, we have 24.44 as the per cent. of Cu_2O that should be present according to his formula, but the direct oxygen determination shows only 16.67 per cent. to be present.

If we assume that all the copper present as Cu_2O in the metal was transformed into the insoluble nitrate by the action of the $AgNO_3$ we have 14.47 per cent. Cu=16.29 per cent. Cu_2O, which is sufficiently close to 16.67 per cent., as found by the O determination, to warrant the assumption as being true.

Thirty grams of the above material were mixed with an equal weight of the pure copper, and the mixture thoroughly melted, when it was removed from the muffle.

The method of examination was enlarged and slightly modified in certain points suggested by the work upon the first sample, with the hope of obtaining more closely concordant results.

The drillings were crushed fine and thoroughly mixed, then the whole was spread out and marked off into twelve squares, and four of these squares were taken for each analysis. Especial attention was given to securing uniformity in the samples weighed out, since some of the differences in the first set of results are due to differences in the samples taken.

The silver separated by the reaction was determined, and the iron remaining in the solution after the separation of the copper was also determined. The following results were obtained:

Sub. taken	Insol. Cu	Sol. Cu	Fe	Ag ppt	Total Cu *Per cent.*	O *Per cent.*	Fe *Per cent.*	Insol. Cu *Per cent.*
3.0846	0.3406	2.6976	trace.	9.4538	98.495	1.504	trace.	11.042
3.3337	0.3768	2.9052	......	10.1969	98.509	1.491	......	11.300
3.2479	0.3521	2.8479	0.00007	9.9700	98.525	1.475	0.002	10.840
				Average	98.507	1.493	......	11.06

Per cent.	Per cent.	
1.493	O =13.33	Cu_2O
11.06	Cu=12.455	Cu_2O

Dividing the total amount of silver precipitated, 29.6207 grams, by the total amount of material taken 9.6662 grams, we have 3.0643 grams as the amount of silver precipitated by 1 gram of the material. Theoretically, 1 gram of a mixture containing 86.67 per cent. copper and 13.33 per cent. Cu_2O should precipitate 3.1544 grams silver, thus

showing a deficiency of 0.0901 gram in the amount of silver precipitated, which indicates that 2.645 per cent. of the copper entered into the reaction without precipitating a corresponding amount of silver. Expressed atomically we have:

Cu present as Cu_2O	11.837÷63.4=0.1867	4.477
Cu not precipitating silver..................	2.645÷63.4=0.0417	1

While these results are not as close as could be desired, yet considering the difficulties in the case arising out of the fact that all the expermental errors are thrown upon the 1.493 per cent. of O, they show that for every 4Cu in the Cu_2O entering into the reaction, one Cu did not reduce its corresponding amount of Ag. Taken in connection with the discovery of nitrite of copper in the filtrate from the silver and basic nitrate, these figures clearly establish the reaction as follows:

Reaction on treating copper containing Cu_2O with $AgNO_3$ in neutral solution.

$$4Cu_2O+Cu+6AgNO_3+6H_2O=2H_6Cu_4N_2O_{12}+CuN_2O_4+6Ag$$

Five grams of the first fusion were mixed with 55 grams of the pure copper and thoroughly fused. Treated in the same way as the second sample, this material yielded the following results:

Sub. taken.	Insol. Cu	Sol. Cu	Fe	Ag ppt.	Total Cu *Per cent.*	O *Per cent.*	Fe *Per cent.*	Insol. Cu *Per cent.*
3.2626	0.2471	2.9801	0.000490	10.3304	98.915	1.070	0.015	7.58
3.5278	0.2781	3.2092	0.000455	11.1430	98.890	1.097	0.013	7.88
3.3826	0.2966	3.0479	0.000560	10.6036	98.873	1.116	0.017	8.77
				Average	98.893	1.092	0.015	8.08

Per cent.	*Per cent.*
1.092 O	=9.75 Cu_2O
8.08 Cu	=9.10 Cu_2O

The composition of the material is therefore:

Per cent.	
90.235	Cu
9.750	Cu_2O
0.015	Fe
100.000	

Nov. 8, 1888.

Performing the same calculations upon these figures as in the preceeding case we have:

Silver precipitated by 1 gram of material.

	Grams.
Calculated	3.2217
Found	3.1531
Deficiency	0.0686

0.0686Ag=2.01 per cent. copper not precipitating Ag

Cu present as Cu_2O	$8.658 \div 63.4 = 0.1366$	4.309
Cu not precipitating silver	$2.01 \div 63.4 = 0.0317$	1

The conclusion arrived at from these figures is that, when copper containing Cu_2O is treated with a neutral solution of $AgNO_3$ in excess in the cold, all the Cu_2O is converted into the insoluble basic nitrate $H_6Cu_4N_2O_{12}$.

LIST OF FOSSIL PLANTS COLLECTED BY MR. I. C. RUSSELL, AT BLACK CREEK, NEAR GADSDEN, ALA., WITH DESCRIPTIONS OF SEVERAL NEW SPECIES.

BY LEO LESQUEREUX, COLUMBUS, OHIO.

[Compiled and prepared for publication by F. H. Knowlton, Assistant Curator Fossil Plants.]

(With Plate XXIX.)

In relation to the exact locality and stratigraphic position of these fossil plants, Mr. I. C. Russell, under date of March 12, 1888,* furnishes the following information:

"The fossil plants which were forwarded to Professor Lesquereux for identification were collected at some small coal mines on Black Creek, about 2 miles northwest of Gadsden, Ala. Black Creek flows south along the axis of the gentle synclinal forming the Lookout Mountain plateau, and furnishes an escape for the drainage of between 50 and 60 square miles at the southern end of that table-land.

"The plants in question occurred in the shale above a seam of coal 18 inches thick, and are all from one stratum, the horizon of which is about 750 or 800 feet above the top of the heavy conglomerate known as Millstone Grit, which forms the abrupt escarpment bounding the Lookout Mountain on all sides. The rocks in which the plants occur evidently belong to the true Coal Measures, and were once continuous with the Great Warrior coal field, from which they have been separated by the elevation of an anticlinal fold, the position of which is now occupied by Wills Valley.

"The southern end of the Lookout Mountain plateau is terminated abruptly by an east and west fault, having a throw of several thousand feet, which has brought the coal-measure strata in contact with shales of Lower Silurian times. This fault occurs at the junction of the synclinal of Lookout Mountain with an anticlinal of equally grand proportions, the erosion of which has produced the broad, level-floored valley stretching south from Atalla and Gadsden. The axes of the two folds we have mentioned fall approximately in the same line, and the adjustment of the fold, one being an upward bending of the rock and the other a downward bending, is accomplished by a fracturing and displacement of the strata. This is the only instance known to me where a great anticlinal and a great synclinal occur end to end in immediate contact."

1. **Calamites ramosus** Artis.

Four specimens; Museum number, 2657.

* In a letter to Prof. Lester F. Ward.

2. Sphenopteris (Diplothmema) Dicksonioides (Göpp.). Schültze.

Two specimens; Museum number, 2661.

3. Sphenopteris (Diplothmema) subgeniculata (Stur.). Schültze.

This may be a variety of the sterile plants of *Sphenopteris harveyi*, Lx., which are the most abundantly represented specimens in both sterile and fertile fragments.

Two specimens; Museum number, 2662.

4. Sphenopteris Höheninghausi Brgt.

One specimen; Museum number, 2663.

5. Sphenopteris divaricata Göpp.

One specimen; Museum number, 2663½.

6. Sphenopteris (Zeilleria) Harveyi Lx. Sterile and fertile plants with rachis, Pl. XXIX, figs. 5, 5*a*, 6.

This fern, extremely variable and represented by many specimens and under divers forms in the collection of Mr. I. C. Russell, was described as *Sphenopteris Harveyi* Lx. (U. S. Coal Flora, p. 766, Pl. 103, figs. 7, 7*b*), and later as *Zeilleria delicatula* Kidst. in Quart. Journ. Geol. Soc., Vol. XL, p. 592, Pl. XXV, the author, Mr. Robert Kidston, considering it as a synonym of *Sphenopteris delicatula* Stern., Vers. I, fasc. II, p. 30, Pl. XXVI, fig. 5; *S. meifolia* Stern., Vers. II, p. 56, Pl. XX, fig. 5. *Cheilantheites meifolius* Goepp., System Filic., p. 241, Pl. XV, figs. 3, 4; *S. delicatula* Brgt., all forms represented by fragments of sterile plants, whose relation to the above species is very obscure and doubtful, while Mr. Kidston's figures represent only the fertile pinnæ and pinnules.

The species had evidently two forms, one for sterile parts of the plants generally larger or at least with pinnules and lobes stronger (Pl. XXIX, figs. 9, 9*c*), with tertiary or ultimate main rachis more or less flexuous or subgeniculate, the pinnæ and pinnules either at right angles or curved down at base, with divisions open or oblique, all the divisions flat; pinnules ovate in outline, two to six lobed; lobes alternate dichotomous or opposite, linear, obtuse at apex, without trace of a medial nerve, except at the base of the primary divisions or pinnules. In other forms the lobes are narrower and longer, filiform, acuminate, open or divaricate, the rachis of pinnæ being subgeniculate, and altogether comparable to *Diplothmema subgeniculata* Stur. In others still, the pinnules are shorter, the lobes shorter, erect, obtuse, bifid at apex, traversed in the middle by a distinct percurring medial nerve, of character similar to those of *Sphenopteris divaricata* Goepp. Indeed the pinnules by their size, their mode of division being either bifid or dichotomous, the lobes flat and without nerves, short and broad, or long and filiform, oblique or divaricate, or distinctly simple nerved, may be compared to a large number of species of *Sphenopteris* with more evidence than to *S. delicatula* Sternb., *S. meifolia* Sternb., etc.

The fertile plants (Pl. XXIX, figs. 5–8) have a broad, flat, distinctly striate primary rachis; the secondary division oblique, with rachis of the same character, the tertiary oblique, or at right angles, with rachis flat and smooth, sometimes round in the middle, and the ultimate divisions oblique, simple, or trifid, curved, bearing at the apex small globose involucrate sporanges parting at maturity into three to five lanceolate lobes curved inward, figs. 8, 5*a*, 6*a*. The divisions of these sporanges are varied apparently from the angle and degree of compression, some of them ovoid, figs. 6, 6*a*, being only split in two lobes. As the sporanges are much larger upon some of the specimens, one might admit two species. But fig. 6 is upon the same specimen as fig. 5, and evidently the form which I have named, var. *robusta*, is, like the multiple forms of the sterile plants, a mere variety, the size of the sporanges depending on a more advanced stage of maturity or on a different position of the pinnæ upon the fronds. The pinnæ seen upon the fertile plants without sporanges do not seem to be sterile pinnules, but merely pedicels from which the sporanges have been detached.

There is no reason for changing the name originally given to the plant. The specific name has priority and the genus *Zeilleria*, though well described by its author, represents only the characters of the fruiting part of plants referable to the group *Sphenopteris* (*Hymenophyllites*), but may be changed until more is known upon the fruiting parts of the numerous species described as *Sphenopteris*.

Six specimens; Museum number, 2664.

7. Sphenopteris Harveyi Lx., var. **robusta** Lx. Plate XXIX, figs. 7, 8.

Seven specimens; Museum number, 2665.

8. Sphenopteris laxifrons ? Zeiller.

One specimen; Museum number, 2666.

9. Sphenopteris polyphylla ? L. & H.

One specimen; Museum number, 2667.

10. Pseudopecopteris (Sphenopteris) macilenta (L. & H.) Lx.

Six specimens; Museum number, 2668.

11. Pseudopecopteris (Sphenopteris) muricata (Brgt.) Lx.

Twenty-four specimens; Museum number, 2669.

12. Pseudopecopteris trifoliata Brgt. sp.

One specimen; Museum number, 2670.

13. Pseudopecopteris latifolia Brgt., sp.

Five specimens; Museum number, 2671.

14. Pseudopecopteris Pluckeneti Brgt., sp.

One specimen; Museum number, 2672.

15. Pseudopecopteris (Sphenopteris) Schillingsii And.

One specimen; Museum number, 2673.

16. Sphenophyllum tenerrimum Ett.

Two specimens; Museum number, 2674.

17. Neuropteris Elrodi Lx. Plate XXIX, figs. 1–3.

In the U. S. Coal Flora, p. 107, I remarked on this species that it might be a variety of *N. Smithii* Lx., and also (*l. c.*) that it is closely related to *N. Duloschi* Stur., Culm Flora, Pl. XI, Fig. 9. In Vol. III of the same work (U. S. Coal Flora, p. 735), I remarked again of the close affinity of *N. Elrodi* and *N. Smithii*, considering them as two different species, the first with oblong, larger, obtuse or obtusely pointed pinnules, the terminal long-lanceolate, acuminate, or blunt at apex, as in Pl. XXIX, figs. 1–3; the second with pinnules very small, nearly round, the terminal shorter and always obtuse, as in Pl. XXIX, fig. 4. At the same time I recognized (p. 736), the identity of *N. elrodi* with *N. Duloschi*. The figures of Pl. XXIX, figs. 1–4, from specimens of Mr. I. C. Russell's collection, where the two forms are represented in many fragments, show the differences in their characters. It is certain that if the two forms ear sometimes found upon the same specimens they are always upon different stems or never attached to the same rachis. I may remark, also, that the finest specimens of *N. Smithsii* were communicated to me from the Coal Measures of Alabama by Prof. Eug. A. Smith, and later by Prof. William M. Fontaine, from West Virginia, and that the specimens from which the species of *N. Elrodi* was first described were sent years after from the Whetstone quarries of the Chester group of Indiana, and that in none of these specimens the two forms are observed. *N. Schlearii* Stur. has priority on *N. elrodi.*

Twenty-five specimens; Museum number, 2675.

18. Neuropteris Smithii Lx., Plate XXIX, fig. 4.

Six specimens; Museum number, 2676.

19. Rachophyllum adnascens L. & H.

One specimen; Museum number, 2677.

20. Calymmotheca Linkii Stur.

Four specimens, Museum number, 2678.

21. Cordaites validus Lx.

One specimen; Museum number, 2658.

22. Trigonocarpus ampullæformis Lx.

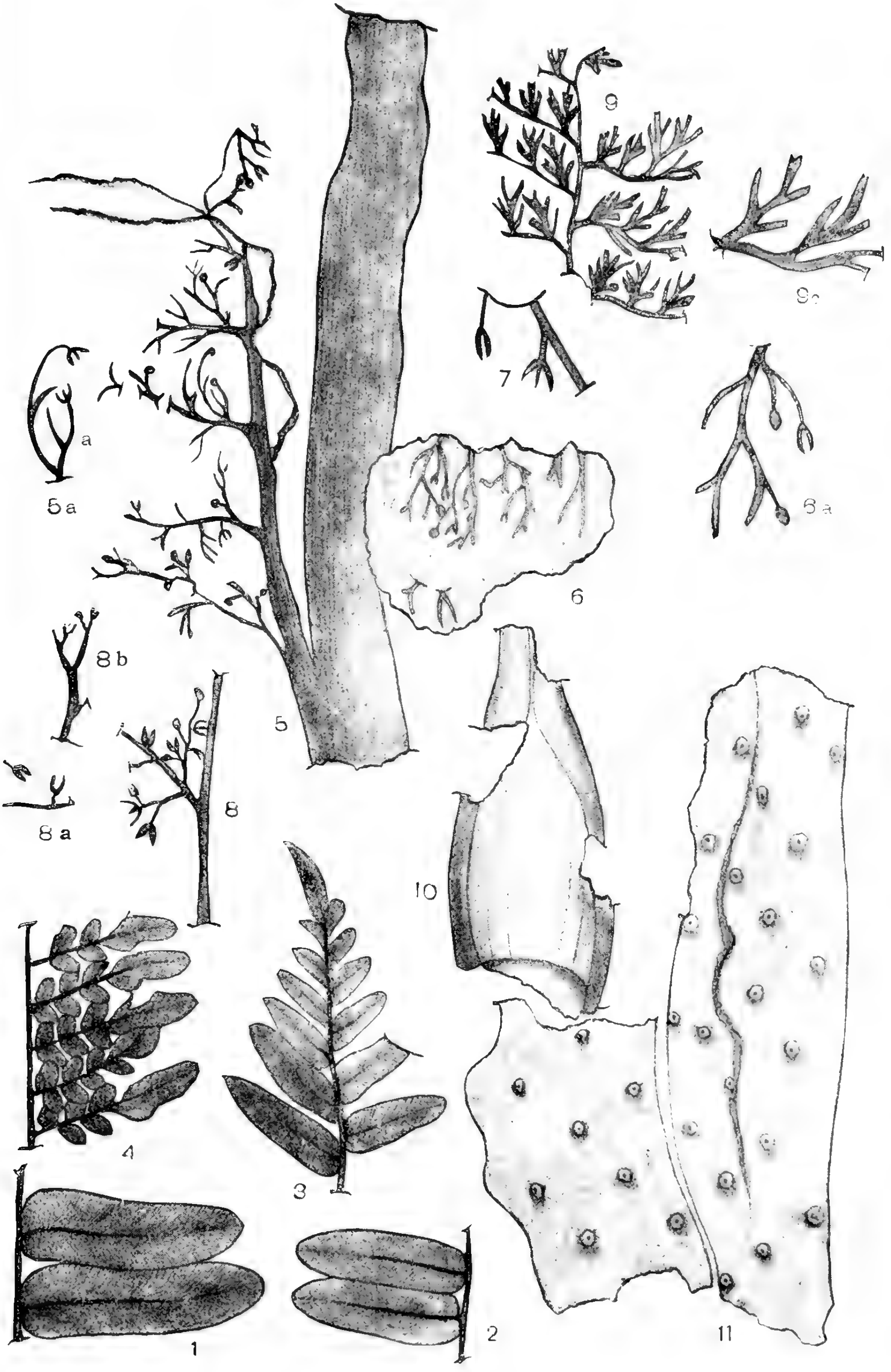
One specimen, Museum number, 2679.

23. Rhabdocarpus multistriatus Sternbg.

One specimen; Museum number, 2680.

24. Rhabdocarpus Russellii, n. sp. Plate XXIX, fig. 10.

Fruit large, ovate in the middle, enlarged truncate (or broken) at base, nucleus oblong, gradually narrowed upward in passing to a narrow tubular appendage, distinct to the apex, outer testa forming a flat border continued upward, enlarged toward the apex; thinly closely striate as well as the surface of the nucleus, truncate at apex.



FOSSIL PLANTS FROM ALABAMA. (Page 83.)

FIGS. 1–3. *Neuropteris Elrodi* Lx.
FIG. 4. *Neuropteris Smithii* Lx.
FIGS. 5, 5a, 6, 6a, 9, 9c. *Sphenopteris Harveyi* Lx.
FIGS. 7, 8, 8a, 8b. *Sphenopteris Harveyi* Lx., var. *robusta* Lx.
FIG. 10. *Rhabdocarpus Russellii*, n. sp
FIG. 11. *Stigmaria Russellii*, n. sp.

Comparable to *Cardiocarpus longicollis* Lx., but smaller, less enlarged in the middle, the marginal ring narrower in the lower part, broader in the upper; surface striate.

One specimen; Museum number, 2681.

25. Lepidodendron aculeatum Sternbg.

One specimen; Museum number, 2659.

26. Stigmaria Russellii, n. sp. Pl. XXIX, fig. 11.

Part of flattened branch or stem; surface narrowly obscurely striate lengthwise; areoles small, in regular spiral or quincunxial order, 1^{cm} distant, round or oval, without rings but with a slightly prominent central point.

Species comparable to *Stigmaria stellaris* Lx. (U. S. Coal Flora, p. 516, Pl. LXXIV, figs. 5, 7), differing by areoles marked with a distinct central vascular scar, the surface smooth or vertically striate. The areoles are a little less than 2^{mm} in diameter. There are, on the reverse of the specimen smooth, flat, linear leaves nearly 1^{cm} broad, similar to leaves of *Stigmaria* possibly referable to the species.

One specimen; Museum number, 2660.

27. Poa-cordaites Grand 'Eury.

One specimen; Museum number, 2682.

EXPLANATION OF PLATE XXIX.

Figs. 1–3. Neuropteris Elrodi Lx., p. 92.
Fig 4. Neuropteris Smithii Lx., p. 92.
Figs. 5, 5*a*, 6, 6*a*, 9, 9*a*. Sphenopteris Harveyi Lx., p. 90.
Figs. 7, 8, 8*a*, 8*b*. Sphenopteris Harveyi, Lx., var. robusta Lx., p. 91.
Fig. 10. Rhabdocarpus Russellii, n. sp., p. 92.
Fig. 11. Stigmaria Russelli, n. sp., p. 93.

ON A NEW SPECIES OF CHARINA FROM CALIFORNIA.

BY E. D. COPE.

(Plate XXXVI, fig. 1.)

Charina brachyops, sp. nov.

Prenasal separated from internasal; postnasal joining preocular, no loral; prefrontal entering orbit; one superciliary; superior labials 8–9.

Muzzle rather elongate; extremity depressed, rostral plate reflected backwards above, but not separating internasals. These are about equal in dimensions to each of the two pairs of the prefrontals, and like them are not separated from each other by scales on the median line. The frontal would be a semicircle, were it not that the anterior border presents a very obtuse angle forwards. This border is continuous with the anterior border of the superciliary, which is not the case in the *C. bottae*. The posterior prefrontal passes in front of the single superciliary, and its posteroëxternal border occupies more of the border of the orbit than does the preocular below it. The parietal is a semicircular band, and it is followed immediately by the usual type of scales. The anterior prefrontals rest at their extremities equally on the postocular and the postnasal. The former is trapezoidal, and is about as high as long; the latter is a little longer than high. The prenasal is very small. Superior labials eight on one side and nine on the other, the eye resting on the third, fourth, and fifth on one side, and on the same plus the sixth on the other. Two postoculars. Three or four pairs of geneials of about the same size as the gular scales. Scales of the body in 45 rows. Tail short, obtuse, with a dermal cap-scale.

Color in alcohol, dark-brown above, light-brown or yellowish below.

Scales, 45; labials, 8–9; length of body, 215; of tail, 28^{mm}.

| 1. | Point Reyes, Cal. | U. S. Fish Comm. | Alcoholic.

The single small specimen described above, stands quite outside the wide range of variation of the *C. bottae*,* presenting characters which might be and have been considered to be of generic importance. The separation of the prenasal, and absence of the loreal plates can not, however, be so used in this group in my opinion.

* The *C.* (*Wenona*) *plumbea* B. & G. does not appear to me to be separable from the *C. bottae* of DeBlainville.

DESCRIPTION OF TWO SPECIES OF PALMOXYLON—ONE NEW—FROM LOUISIANA.

BY F. H. KNOWLTON, ASS'T CURATOR FOSSIL PLANTS.

(With Plate XXX.)

On February 29, 1886, several specimens of fossil palms were received in the Department of Fossil Plants of the U. S. National Museum that had been collected by Mr. Lewis C. Johnson, of the U. S. Geological Survey, in Rapides Parish, La. They appeared to be very well preserved fragments, in some cases nearly 8 inches in diameter, and from 3 to 5 inches in length. They are completely silicified, and are yellowish-gray in color. The fibro-vascular bundles show very distinctly in transverse section, and their irregular or undulating course through the stone is also clearly shown when broken longitudinally.

The difficulties in the way of the satisfactory determination of monocotyledons, by a study of internal structure alone, are much greater than the determination from similar parts of conifers or dicotyledons. The reasons for this are, that monocotyledonous stems are in general less susceptible of satisfactory preservation in the fossil state, consisting as they do largely of parenchematous tissue, with large intercellular spaces; and also because the study of living forms, which furnishes the basis for all studies of fossil forms, has not been as exhaustively undertaken. Particularly is this true of the study of fossil palms. So little is at present known regarding the internal structure of the living species that it is only possible in the present state of our knowledge to mass together all the fossil species under the comprehensive generic name of Palmoxylon, or simply "palm-wood." It is true that the described species of Palmoxylon differ considerably among themselves, and it is more than probable that characters will ultimately be obtained that will allow of a separation into several generic types.

Two generic types, Fasciculites and Palmacites, were recognized by the earlier writers, mainly from the microscopic appearance of the trunks; but Schenk, who had opportunity of studying much of the original material as preserved in the Dresden Museum, concluded that it was on the whole best to recognize only a single generic type, for which he proposed the name Palmoxylon.* The most complete enumeration of species is that given by Dr. Felix in his exhaustive paper on the Fossil Woods of the West Indies.† Most of the species mentioned come from the island of Antigua, but several are from European localities.

*Engler's Botan. Jahrb., Vol. III, 1882, p. 355.

†Die foss. Hölz. Westindiens. Samml. paläont. Abhandl., Ser. I, Heft 1. Cassel, 1883, pp. 22–27, Pl. IV, V.

The species are divided by Felix into two sections, the first of which includes those having sclerenchyma bundles scattered between the fibro-vascular bundles, and the second of which includes the species without sclerenchyma bundles. The first section includes most of the species described by Felix. The two species from Louisiana represent both sections.

The species belonging to the first section I am inclined to identify with a species described by Felix, from Antigua, although it differs from it in some relatively important features.

Palmoxylon Quenstedti Felix, Foss. Hölz. Westindiens, p 25, Pl. IV, fig. 4.

Described by Felix as follows: Fibro-vascular bundles extraordinarily numerous, the bast portion strongly developed, and the xylem portion very much reduced, or not well preserved. Sometimes the bast portion surrounds the xylem and sieve tissues, so as to give the appearance of their lying in an opening of the bast tissue. Numerous isolated bundles (Faserbündeln) of very considerable size appear about the fibro-vascular bundles. The fundamental or parenchymatous tissue is composed of long, but rather small, cells without intercellular spaces.

The form from Louisiana agrees well with this description, but has not been as well preserved. The fibro-vascular bundles have been very numerous, particularly near the periphery of the stem, as also have been the smaller sclerenchyma bundles.

The fundamental tissue has not been preserved except in immediate contact with the fibro-vascular bundles. It is then seen to be composed of small, nearly regular, cells, with few small intercellular spaces among them.

The specimens from Antigua upon which this species is founded, were first collected by Quenstedt in 1867,* who recognized at once their palm-like structure. They were opalized in a very beautiful manner.

Palmoxylon cellulosum, n. sp. Plate XXX, fig. 2.

This species, as stated above, belongs to the section characterized by the absence of sclerenchyma bundles outside of and among the fibro-vascular bundles. The fundamental tissue is composed of large, irregular cells, between which are very large intercellular spaces. The tissue is more compact in the vicinity of the bundles, but is loose and spungy in general. The fibro-vascular bundles have been moderately numerous. They are large, usually elliptical in outline. The bast cells are large, with the lumen reduced to a minimum, while the xylem portion is nearly completely surrounded.

The fundamental tissue of this species bears a strong resemblance to that of *Palmoxylon lacunosum* Felix, and would be referred to it but for the absence of the isolated sclerenchyma bundles, which so clearly marks the species of Felix.

Rapides Parish, the locality from which these fossils were obtained,

---

*Handbuch d. Petrefactenkunde, 2. Aufl., p. 883.

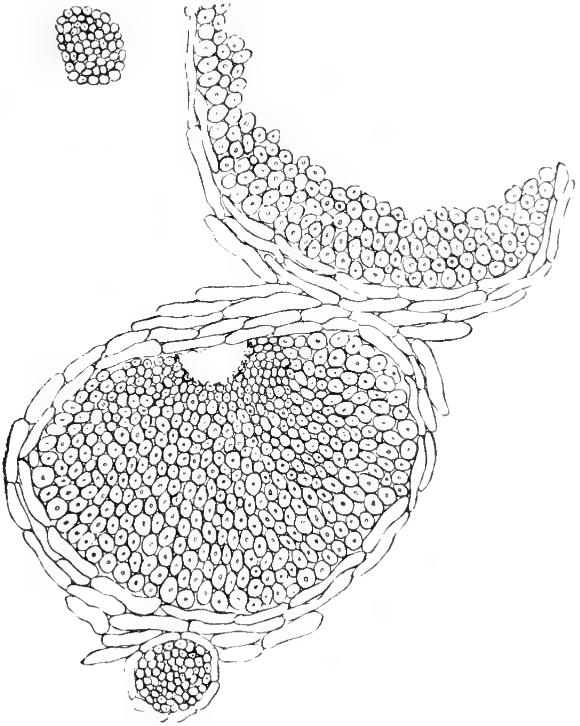


FIG. 1. *Palmoxylon Quenstedti* Felix. (Page 90.) FIG. 2. *Palmoxylon cellulosum*, n. sp. (Page 90.)

is thought by the collector, Mr. Johnson, to be of Pliocene Age. It belongs, as I am informed by Mr. W. J. McGee, of the U. S. Geological Survey, to the Grand Gulf of Hilgard, a formation usually regarded as Miocene, but concerning the age of which we really know very little, and all determinations of position must be regarded as tentative until more complete data are obtained.

The geologic horizon from which the *Palmoxylon Quenstedti* Felix was obtained is also in doubt. Hovey, who has contributed a paper on the Geology of Antigua,* inclines to regard it as belonging to the younger Pliocene, but Felix† thinks it may possibly be older. It would be interesting if this locality could be correlated with that from Louisiana, but in the present state of our knowledge this is manifestly impossible.

*Am. Journ. Sci., Vol. xxx, 1839, pp. 75–85. †*L. c.*, p. 8.

Nov. 8, 1888.

DESCRIPTION OF A NEW WESTERN SUBSPECIES OF ACCIPITER VELOX (WILS.) AND SUBSPECIFIC DIAGNOSIS OF A. COOPERI MEXICANUS (SWAINS.).

BY ROBERT RIDGWAY.

Accipiter velox rufilatus, subsp. nov.

SUBSP. CHAR.—*Adult male* with markings of lower parts paler and more cinnamomeous, the thighs with cinnamon-rufous usually predominating; *adult female* with markings of lower parts larger and darker than in true *A. velox; young* (especially female) more heavily marked beneath than in true *A. velox*.

HAB.—Western North America, east to Rocky Mountains, north to Kodiak, south into Mexico.

This separation is based on the careful comparison of more than eighty specimens of the two forms.

2. **Accipiter cooperi mexicanus** Swains.

Accipiter mexicanus SWAINS. F. B. A. II, 1831, 45, foot-note (Real del Monte, Mexico).

SUBSP. CHAR.—*Adult males* scarcely or at least not constantly different from those of true *A. cooperi; adult females* usually with markings of lower parts denser and rather deeper in color, with more of rufous on thighs; *young* (especially females) much more heavily marked beneath, the thighs heavily spotted instead of streaked.

HAB.—Western United States and south into Mexico.

A careful comparison of more than sixty specimens of this species shows clearly that western specimens differ from eastern examples in the above-mentioned characters.

Proceedings U. S. National Museum, vol. xi, 1888.

FURTHER CONTRIBUTIONS TO THE HAWAIIAN AVIFAUNA.

BY LEONHARD STEJNEGER.

Mr. Valdemar Knudsen has again favored the National Museum with an important collection of Hawaiian birds, consisting exclusively of water-birds, all of particular interest. The collection contains a species new to science, besides several additions to the Hawaiian fauna.

As in the foregoing collections received from the same source, most of the specimens are from the island of Kauai, but, in addition, the present one contains several examples from the neighboring Niihau, a small island situated 13 miles southwest of Kauai.

In the following paper all the measurements are in millimeters, and the nomenclature is that of the A. O. U. code.

The native Hawaiian names are given on Mr. Knudsen's authority.

Puffinus knudseni, sp. nov.

Knudsen's Shearwater.

Uau kane.

Diagnosis.—Tail nearly half as long as the wing, graduated for the length of the tarsus; nasal tubes short, about one-fifth the length of the chord of culmen, raised above the level of the bill, inflated and obliquely cut anteriorly; nostrils roundish and wholly visible from above; nasal septum broad; color above sooty grayish, scapulars and interscapulars with paler more brownish margins; head, especially forehead, suffused with ashy, rump more blackish; ear-coverts like upper parts; lores and cheeks more ashy, gradually fading into the white of the under parts; flanks, crissum, and under tail-coverts sooty like the back; lining of wing white, axillaries gray; bill (dried) horny reddish gray, tube, culmen, and nails blackish; feet very pale horny yellowish (probably yellowish flesh color in fresh bird), somewhat browner on the outer side.

Dimensions of type specimen.—Wing, 287^{mm}; tail-feathers, 138^{mm}; chord of exposed culmen, 37^{mm}; tarsus, 46^{mm}; middle toe, with claw, 54^{mm}; graduation of tail, 49^{mm}.

Habitat.—Hawaiian Islands.

Type.—U. S. Nat. Mus., No. 113445; Kauai, Hawaiian Islands; Valdemar Knudsen, coll.

Knudsen's Shearwater belongs to the subgeneric group usually called *Thiellus* "GLOGER,"* which is characterized by the long and strongly

---

* Gloger, in 1827 (Froriep's Notizen, XVI, p. 279), proposed the name *Thyellas* (not *Thyellus*) as a substitute for the barbarous *Puffinus*. This name can not be restricted to the Long-tailed Shearwaters, as none of these species were known in 1827. As the group seems to be without a name, I would propose *Thyellodroma* (θύθελλα = gale, δρομάς = running) with *Puffinus sphenurus* for a type.

graduated tail. It is in reality closely allied to *P. sphenurus*, and consequently very distinct from any Shearwater hitherto known to occur in the Eastern Pacific. The discovery of the present species in the Hawaiian Archipelago, therefore, is one of particular interest. With no specimens of *P. sphenurus* for direct comparison, it is difficult to state the structural differences between the two species, especially since the size and proportions seem to be nearly the same, though *P. knudseni* has apparently somewhat shorter toes than *P. sphenurus*.

I have but little to add to the above diagnosis, except that the remiges are white at the base of the inner webs, the white gradually increasing inwards, so that on the proximal secondaries it occupies the basal half of the inner web.

In general coloration the new species bears great resemblance to *P. gavia* (FORST.) and *P. creatopus* (COUES), but besides being easily distinguished from both by its long tail and the shape of the nasal tubes, it differs from *P. gavia* in being much larger and in having gray axillaries, while its white lining of the wing and the absence of gray mottling on the throat and sides of neck distinguish it from *P. creatopus*.*

Mr. Knudsen writes me in regard to the present species, which, according to his label, is called "Uau kane" by the natives, that it was formerly found plentiful every summer at the top of the mountains as high up as 5,000 feet, where they had their nests in long burrows, but that in the last ten years they have become rare, as the foreign rats kill them in their nests.

Anous melanogenys GRAY.

Black-cheeked Noddy. Noio.

1846.—*Anous melanogenys* GRAY, Gen. B., III, pl. clxxxii.
1854.—?*Anous tenuirostris* LICHTENSTEIN, Nomencl. Av. Mus. Berol., p. 97 (*nec* TEMM.).

Mr. Knudsen sends four specimens of this addition to the Hawaiian fauna, all four being from the island of Niihau. Mr. Dole (Haw. Alm., 1879, p. 57) only enumerates *A. stolidus* (LINN.) as occurring in the Hawaiian Islands, but the two species are very similar and may easily be confounded. On the other hand, the ranges of the two species are such as to make it probable that both may occur in the same archipelago.

The chief differences between the two species are as follows:

A. melanogenys is a smaller bird with the bill much slenderer and straighter, its height at base being 7 to 7.5^{mm} against 10^{mm} in *A. stolidus*; in the former the whole top of the head is distinctly whitish, while in the latter the forehead only is whitish. In the Southern Pacific there is a species similar to *A. melanogenys*, viz. *A. leucocapillus* GOULD, but this has the white of the top of the head abruptly defined behind, and not fading gradually into the dark ashy on the upper neck. Another

* Since the above was placed in the printer's hand Mr. Salvin (Ibis, 1888, p. 353) has described a *Puffinus cuneatus*, which, in some respects, agrees closely with our bird. His description differs, however, in several important points, making it probable that we have to do with two different species.

allied species, *A. tenuirostris* (TEMM.), from the Indian Ocean, is characterized by the lores being whitish, not black, as in our species. *A. melanogenys* is often confounded with the latter in the museums, and it is probable that the *A. tenuirostris* mentioned by Lichtenstein as being in the Berlin Museum from the Sandwich Islands (Nomencl. Av. Mus. Zool. Berol., p. 97) belong to the former.

The measurements of the Hawaiian specimens are as follows:

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail feathers.	Exposed culmen.	Height of bill at base.	Tarsus.	Middle toe with claw.
113455	Knudsen..	♂ ad.	Niihau, Hawaiian Islands.	....	219	118	41	7.5	20	31
113456	......do ...	♂ ad.	......do	....	233	126	41	7.5	20	31
113457	......do ...	♀ ad.	......do	....	218	117	......	7.0	20	30
113458	......do ...	♀ ad.	......do	....	215	119	42	7.5	20	31

Mr. Kundsen observes that "the Noio live on the rocks about the coast and are not often seen by foreigners."

Fulica alai PEALE.

Hawaiian Coot. Alai keokeo.

1826.—*Fulica atra* BLOXHAM, Voy. Blonde, p. 251 (*nec* LINN.).

1848.—*Fulica alai* PEALE, Zool., U. S. Exp. Exp., Birds (p. 224, pl. lxiii, fig. 2).—HARTLAUB, Wiegm. Arch. Naturg., 1852, p. 137.—*Id.*, Journ. f. Orn., 1854, p. 170.—CASSIN, U. S. Exp. Exp., Orn., p. 306, pl. xxxvi (1858).—*Id.*, Proc. Acad. Philada., 1862, p. 322.—GRAY, Cat. B. Trop. Isl. Pacif., p. 54 (1859).—PELZELN, Verh. Zool. Bot. Ges. Wien, 1873, p. —; Extr., p. 7.—STREETS, U. S. Nat. Mus., Bulletin 7, p. 21 (1877).—SCLATER, P. Z. S., 1878, p. 351.—*Id.*, Rep. Voy. Challenger, Zool., II, pt. VIII, p. 99 (1881).—FINCH, Ibis, 1880, pp. 78–79.—WALLACE, Isl. Life, p. 296 (1881).—STEJNEGER, Proc. U. S. Nat. Mus., x, 1887, p. 80.

1869.—*Fulica alae* DOLE, Proc. Boston Soc. N. H., XII, p. 302; Extr., p. 9.—*Id.*, Hawaiian Alm., 1879, p. 54.

The two specimens sent corroborate the statement already made (Proc. U. S. Nat. Mus., x, 1887, p. 80) that this species, which is abundant on the southern islands, likewise occurs in Kauai.

Measurements.

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Culmen including frontal shield.	Bill from loral apex.	Tarsus.	Middle toe with claw.
113453	Knudsen..	♂ ad.	Kauai, Hawaiian Islands.	....	172	47	53	29	55	86
113454	....do.....	♀ ad.	.... do	....	168	45	49	29	52	81

Arenaria interpres (LINN.).

Turnstone. Akekeke.

The native name here given is the same as that previously given for the Sanderling (*Calidris arenaria*, Proc. U. S. Nat. Mus., x, 1887, p. 82), but the two birds should not be confounded, and "Akeke Kakiowai" may be the proper name for the last mentioned species.

The two specimens sent appear to be young birds in winter plumage. They were collected on the island of Niihau.

Mr. Dole has already recorded this species from Kauai under the name of *Strepsilas interpres* (Hawaiian Almanac, 1879, p. 51).

Measurements.

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
113465	Knudsen........	♂ jun.	Niihau, Hawaiian Islands.	....	148	63	23	25	27
113466	......do	♀ jun.	.......do	....	140	61	20	25	26

Himantopus knudseni STEJN.

(Proc. U. S. Nat. Mus., x, 1887, p. 81.)

Two specimens from Niihau confirm the validity of this species. The peculiar coloration of the tail alluded to in the original description is also found in these, though less pronounced in No. 113463. The additional specimens, however, present another very strongly marked character which I did not mention in describing the type specimen, because most of the feathers in question were wanting, viz, that the longest upper tail-coverts have the inner webs entirely black, and that the down surrounding the uropygial gland are blackish. In some of the specimens of *H. mexicanus* the upper tail-coverts are more or less suffused with light gray, but I have found nothing like the broad median black stripe covering the base of the tail in *H. knudseni*.

The type specimen having a greenish black back is undoubtedly a male, while the two Niihau birds appear to be females, having the back brownish.

The appended table of dimensions corroborates the deduction previously made as to the relative proportions of the two species. Their wings and toes are of the same length, but *H. knudseni* has longer bill, tarsus, and tail.

Measurements.

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
110024	Knudsen*	(♂)ad.	Kauai, Hawaiian Islands.	....	232	87	75	121	47
113463	....do	(♀)ad.	Niihau, Hawaiian Islands.	....	227	81	80	117	46
113464	.. do	(♀)ad.	......do	....	221	80	74	113	45

* Type.

Numenius femoralis Peale.

Bristle-thighed Curlew. Kioea.

(Proc. U. S. Nat. Mus., x, 1887, p. 83.)

Four additional specimens from Niihau show that this bird, originally added to the Hawaiian avifauna by Mr. Knudsen, was by no means an accidental straggler to the islands. In his letter to me he remarks, however, that the "Kioea" is a rare bird there, though almost always to be found in the localities affected by it, but he does not believe it to nest in the islands.

The bristly elongation of the shafts of thigh-feathers are well developed in all four specimens.

I may add that all four specimens are molting their inner primaries.

Measurements.

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
41953	Knudsen	ad.	Kauai, Hawaiian Islands	....	240	92	93	56	45
113459	... do	♂ad.	Niihau, Hawaiian Islands	....	226	96	86	56	44
113460	....do	♂ad.	..... do	....	240	97	90	59	44
113461	... do	♀ad.	......do	....	227	95	84	57	42
113462	... do	♀ad.	......do	....	234	95	89	56	......

Dafila acuta (Linn.).

Pintail. Koloa mapu.

This is another addition to the Hawaiian fauna. Like the following species, it is only a winter visitor to the islands, going north in spring to breed.

The specimen sent is a fine male, measuring as follows:

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
113451	Knudsen	♂ ad.	Kauai, Hawaiian Islands ...	....	270	112	52	43	57

Spatula clypeata (LINN.).

Shoveller. Koloa moha.

This Duck, which has already been recorded by Mr. Dole and several visiting naturalists as occurring in the islands during winter, seems to be comparatively common.

Mr. Knudsen's specimen is a male in winter plumage, apparently a bird of the year.

Measurements.

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
113452	Knudsen	(♂).	Kauai, Hawaiian Islands ..	....	243	90	61	38	55

Anas wyvilliana SCLATER.

Hawaiian Duck. Koloa maoli.

1852.—*Anas boschas?* HARTLAUB, Wiegm. Arch. Naturg., 1852, p. 137 (from spec. in Mus. Berol. ex Oahu).—GRAY, Cat. B. Trop. Isl. Pacif., p. 54 (1859).

1854.—*Anas boschas* var. HARTLAUB, Journ. f. Orn., 1854, p. 170.

1856.—*Anas superciliosa a. sandwichensis*, BONAPARTE, Compt. Rend., XLIII, 1856, p. 649 (*nom nud.*).

1859.—*Anas superciliosa* var. GRAY, Cat. B. Trop. Isl. Pacif., p. 54.

1862.—*Anas boschas* CASSIN, Proc. Acad. Philada., 1862, p. 322.

1869.—*Anas superciliosa* DOLE, Proc. Boston Soc. N. H., XII (p. 305); Extr., p. 12 (*nec* GMEL.).—*Id.*, Haw. Almanac, 1879, p. 55.

1878.—*Anas wyvilliana* SCLATER, P. Z. S., 1878, p. 350.—*Id.*, Rep. Voy Challenger, Zool., II, pt. VIII, p. 98, pl. XXII (1881).—RIDGWAY, Proc. U. S. Nat. Mus., I, 1878, p. 251.—FINSCH, Ibis, 1880, p. 79.—WALLACE, Island Life, p. 296 (1881).

Of this interesting Duck peculiar to the Hawaiian Archipelago the collection contains four specimens, two of which on the labels are designated as "Koloa maoli," while the other two are inscribed "Koloa piwai." I can see no difference between the specimens so marked.

As the original description and figure of this species are somewhat defective, and as the specimens before me offer some differences of plumage not hitherto recorded, a somewhat detailed account of my material may not be out of place.

A few words in regard to the true relationship of the species may be in order first, as the original description in a general way only refers it to "the section of true *Anas*, which embraces *A. obscura* of North America, *A. superciliosa* of Australia, and other species." From the synonymy as given above it might be supposed that the relationship of the present species would be with *A. superciliosa*, the habitat of which is given as embracing nearly entire Polynesia, besides Australia and New Zealand, but in point of fact it has nothing to do with the Polynesian species, as its closest allies are found on the American continent just opposite the Hawaiian Islands; or, to be more specific, *A. wyvilliana* is very closely related to *A. aberti* RIDGW. of northwestern Mexico, as already pointed out by Mr. Ridgway (Proc. U. S. Nat. Mus., I, 1878, p. 251). So close is the similarity that I am unable to distinguish No. 113450, *A. wyvilliana* (♀), from the type of *A. aberti* (♀) except by the larger size and the total absence even of an indication of supraocular or transocular stripes; the former specimen is also distinguished by white tips to the greater wing coverts, forming a white anterior border to the green speculum, but this is wanting in the other specimens as well as in the type of *A. aberti*.

On the whole, the five specimens of *Anas wyvilliana* before me, though agreeing rather closely in general coloration, present a number of extraordinary variations truly perplexing.

Nos. 113447 and 113449 I take to be correctly determined as males, for they have the central tail-feathers turned up at the end in a manner similar to that of the male *Anas boschas*.* They also differ from the other three specimens before me in having the smaller upper wing-coverts nearly uniform "hair brown" (Ridgw., Nom. Col., pl. iii, n. 12) with but faint grayish margins, while the other three have these feathers distinctly and, more or less, broadly margined with cinnamon. The two males, furthermore, have a slightly stronger greenish gloss on the occiput and upper hind neck, but here the agreement between them, as compared with the three other specimens, comes to an end.

No. 113449 has a small black bill, with an ill-defined yellowish space on each side of the upper nail, and a somewhat asymmetrical longitudinal mark of similar color on the middle of the column, and a yellowish area separating the under nail from the dark basal half of the lower mandible, while in No. 113447 the bill is pale brownish, becoming light plumbeous towards the base, with a triangular black mark on the lower basal angle of the upper mandible exactly as in *Anas fulvigula* RIDGW. In No. 113449 the top of the head, occiput, and upper neck are nearly

* The occurrence of the recurved central tail-feathers in this species is exceedingly interesting, as they are said to be entirely wanting in *Anas obscura* and the still more closely allied *A. fulvigula* from Florida. That these curious feathers are not indicated in the original description nor in the figure (P. Z. S., 1878, and 'Challenger' Rep.) is easily explained by the fact that the type was collected in August, at a time when these feathers are normal even in *A. boschas*. Our specimens are apparently winter birds.

uniform dull blackish brown, with a greenish gloss on occiput and neck, while the fore-neck has a whitish ground color striped with blackish; in No. 113447, on the other hand, these parts are colored as in the female, pale cinnamon striped with dusky underneath, and dusky striped with pale cinnamon above, though with a stronger greenish gloss than in the females. No. 113449 has the anterior white wing-band nearly twice as broad as the corresponding one in 113447. Lower wing-coverts and lower tail-coverts show great difference in the two specimens, No. 113447 agreeing in the coloration of these parts with the other three specimens in having the entire lining of the wing, including the axillaries, pure white, and in having the lower tail coverts whitish, more or less tinged with tawny and cinnamon rufous, and spotted or barred with dusky; No. 113449, however, has all the small under wing-coverts brownish gray, with broad, pale margins, and the under tail-coverts are deep cinnamon rufous, heavily blotched with black, some of the middle ones being entirely black, with a faint greenish gloss. Also among the upper tail-coverts of the same specimen there are a few uniform greenish-black feathers.

No. 113448 is said to be a male by the collector, but, if so, it is probably a younger bird than the two already spoken of, for not only are the central tail-feathers perfectly straight, but the smaller upper wing-coverts are broadly margined with cinnamon, while several of them in addition have a central pale heart-shaped mark distally circumscribed with black; the nape has a greenish gloss, but slightly fainter than in the foregoing specimens, but the lower neck and upper breast are more rufous than any of the specimens at hand; the upper white wing-band is narrow and considerably clouded with gray. Bill as in No. 113447.

The last two specimens are said to be females, and are probably correctly sexed, but they present great differences *inter se.* No. 21319 (the same one described by Mr. Ridgway, *loc. cit.*, though the number by a misprint is given as 20319) seems to be the more normal of the two, but the upper white wing-bar is nearly as obsolete as in the type of *A. aberti*, it being only represented by a narrow, ill-defined, pale drab-gray band, and round the eye there is a somewhat irregular ring of white feathers. The latter feature, however, is probably purely albinistic, there being also a few small white feathers here and there on the face, and none of the other specimens show even an indication of an eye ring. The bill appears to be like that of Nos. 113447 and 113448. The tawny margins to the smaller upper wing-coverts are narrower than in the foregoing and following specimens.* No. 113450, the last of Knudsen's birds, is particularly interesting and aberrant. While all the other specimens have the throat streaked with dusky, this one has the chin, throat, upper fore-neck and the loral apex uniform, pale vina-

*The specimen just described was probably obtained in March, 1856, at Hilo, Island of Hawaii, consequently in the identical locality whence came the type of *A. wyrilliana*.

ceous cinnamon-rufous precisely as in *A. aberti*. The normal upper white wing bar is replaced by one of a light gray color, but in addition the greater coverts which form the upper border of the speculum,* are broadly (5^{mm}) tipped with pure white, thus interposing a very conspicuous and abnormal white bar between the speculum and its upper black border. So far as I can make out, this feature is entirely unique.† The two black tertiaries following the speculum and forming its inner black border, have some large pale cinnamon marks and broad margins at the tip, of a similar color, while in all the other specimens these feathers are uniform. The bill is brownish, with black blotches irregularly distributed over the surface.

Some of the differences noted above are probably due to sex, others to age, and others again to season, but with the scanty data as to sex and time I abstain from making any suggestions. It is plain, however, that a few of the variations can not be disposed of so easily. As to the reversed position of the black and white in the anterior border of the mirror (No. 113450) I may remark, that our museum possesses a number of pale, albinistic specimens, said to have been tame ducks having turned feral and shot on the Lower Potomac, in which a similar reversion of the two colors has taken place. Some of these specimens have only the tips of the greater coverts margined more or less broadly with white; in others the white margins also run along the edges to the base, while in others again these feathers are entirely white. But all these birds are albinistic to a great extent besides, while our Kauai specimen shows no other trace of albinism. As to the curious dark lining of the wing of No. 113449, I have at present no explanation to offer.

In all the allied species I find a light superciliary line and a dark transocular stripe more or less pronounced. No such pattern is evident in my Hawaiian specimens, the only approach to it being a scarcely perceptible postocular dark line in all, except No. 113449.

*In the original description of *Anas wyvilliana* a curious mistake has crept in, inasmuch as it is said that the speculum proper is formed by the greater coverts and its upper double border by the smaller coverts. The passage in question reads as follows: "The speculum is shining purple with a black border above and below: beyond the black border below the coverts terminate in a broad margin of pure white; above the upper black border, which is formed by the ends of the small coverts, there is a narrow ashy-white margin." Of course, the speculum is formed by the secondaries, and the upper border by the ends of the great coverts! Besides the speculum is only purple in a certain light, viz, when held between the light and the eye (Gadow's "position C"), while if the eye be placed between the light and the bird ("positions B and A"), the speculum is distinctly green, which is also the color represented in the plate.

†In Mr. Ridgway's account of the female *A. wyvilliana* (*loc. cit.*) there is a remark to the effect that the above described arrangement of the borders is the normal one in *Anas boschas*, but this is evidently only a slip of the pen.

Measurements.

U. S. Nat. Mus. No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Width of bill at nostrils.	Tarsus.	Middle toe with claw.
113447	Knudsen	♂ ad.	Kauai, Hawaiian Islands.	....	273	78	45	17.5	41	57
113449	...do	♂ ad.	...do	....	221	77	43	17.5	39	52
113448	...do	......	.. do	....	234	79	48	19	40	54
113450	...do	♀ ad.	...do	....	(*)	82	44	18	39	......
21319	Stimpson, y. 379...	♀ ad.	Sandwich Islands.	....	224	74	45	17.5	.....	.....

* First primary molting.

Nycticorax nycticorax nævius (Bodd.).

Black-crowned Night Heron. Auku kohili.

(Proc. U. S. Nat. Mus , x, 1887, p. 84.)

The additional specimen, an adult male, confirms the identification of this form. It is rather dark, though not much darker than average American skins, and much lighter than specimens from Chili (*N. obscurus*). From the table below it will be seen that the measurements are in excess of those of the Old World birds (*cf.* Proc. U. S. Nat. Mus., x, 1887, p. 269). The Hawaiian Night Heron, therefore, agrees with the American form in every respect.

Measurements.

U. S. Nat. Mus. No.	Collector.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
113467	Knudsen..........	♂ ad.	Kauai, Hawaiian Islands	....	310	111	79	78	84
41951	...do	. ad.	.... do	....	(*)	102	75	77	83
41952	....do	juv	.... do	....	† 285	104	72	70	77

* Primaries molting. † Primaries very much worn.

Fregata aquila (Linn.).

Man-o'-War Bird. Iwa.

In the first edition of his "Synopsis" (Proc. Boston Soc. Nat. Hist., XII) Mr. Dole enumerated the Frigate Bird under the above specific name, but in 1879 (Hawaiian Almanac) he corrected the identification as erroneous, and substituted for it the name *Tachypetes palmerstoni*, without stating his reasons for so doing. It seems, however, as if he made the change under the impression that "*Tachypetes aquila*, a similar but much larger bird of the Atlantic Ocean," is confined to the latter, and that no other species than the small one (the correct name of which

is *Fregata minor*) occurs in the "tropical belt of the Pacific and Indian oceans." This is not quite exact, for while *F. minor* is restricted to the Pacific, and particularly its southern part, *F. aquila* is found in both oceans, especially north of the equator, and the specimen from Kauai, sent by Mr. Knudsen, belongs to the large form. As Dr. Streets has found *F. minor* on the Fanning Islands (Bull. U. S. Nat. Mus. No. 7, p. 25), it is quite likely that it may also occur, at least occasionally, in the Hawaiian Archipelago.

Knudsen's specimen is a female, with the head, hind neck, lower breast, and belly blackish; upper fore-neck grayish; chest whitish, strongly suffused in the middle with ochraceous buff; smaller upper wing-coverts grayish brown with darker centers and paler margins.

The measurements of this specimen are as follows:

U. S. Nat. Mus. No.	Collector.	Sex.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
113446	Knudsen	♀....	Kauai, Hawaiian Islands	....	595	345	120	25	73

NOTE ON ÆSTRELATA SANDWICHENSIS RIDGW.

BY ROBERT RIDGWAY.

In volume IX of these proceedings, p. 96, in an additional note to an article on this bird, I expressed a suspicion that it might be the same as *Æ. phæopygia* Salv. (Trans. Zool. Soc. Lond., Vol. IX, Part IX, May, 1876, p. 507, pl. 88, fig. 1), and in my more recently published "Manual of North American Birds"* (p. 65) relinquished any doubt as to the question by giving the Sandwich Island bird as *Æ. phæopygia*. In the mean time the type had been sent to Mr. Salvin for comparison with the types of his species, and his letter, dated December 11, 1887, confirms the views which I had adopted, as the following quotation from his letter will show:

"I have compared it [*i. e.*, the type of *Æ. sandwichensis*] with the two types in the British Museum of *Æ. phæopygia*, and done my best to make them different, but they are as like as any three specimens of the same species of Petrel that I ever examined. The bill is a trifle small in all its dimensions and outer rectrices a little more freely mottled with white, but the Galapagos birds vary just as much *inter se*."

* J. B. Lippincott Company, Philadelphia, 1887.

ON THE SERPENTINE OF MONTVILLE, NEW JERSEY.

BY GEORGE P. MERRILL.

(With Plates XXXI, XXXII.)

Being in common with petrographers in general deeply interested in the problem of the origin of serpentinous rocks, the writer took occasion, during the summer of 1887, to visit sundry localities where the rock was known to occur, and among them, that at Montville, N. J. This locality was looked forward to with especial interest, since owing to the rare beauty, purity, and compactness of the rock, as shown in numerous mineral cabinets throughout the country, and its known occurrence imbedded in a massive dolomite, it was thought that here, if anywhere, it might be found as a rock formed from aqueous sediments of chemical origin, as argued by Dr. Hunt.* The results of my examinations are given below:

As above noted, the serpentine occurs associated with a massive, coarsely crystalline dolomite, and the fine specimens to be found in the various museums are obtained during the process of quarrying this rock for burning into quicklime or for a flux in iron furnaces.

The first noticeable thing regarding the serpentine is, that while it is occasionally found in small seams and veins, its principal mode of occurrence is the form of isolated nodules from a few inches to 1 or 2 feet in diameter, or as a thin coating on large irregularly rounded or oval bowlder-like masses of all sizes up to 8 or 10 feet in diameter, and which from their crystalline texture and white or gray color seem in most instances to have been mistaken for the ordinary dolomite of the quarry.

The smaller nodules separate readily from the inclosing dolomite, and present always highly polished and often beautifully grooved and slicken-sided surfaces, which are covered here and there with patches of a thin foliated, somewhat fibrous, light yellowish-green mineral resembling picrolite, but which examination proves to be otherwise, as will be noted later.

The exterior of many of these nodules is strikingly like that of pebbles scarred by glacial action, and present other features such as to suggest they have been subjected to a considerable compressive force. When broken open the nodules are found, as a rule, not to consist of serpentine throughout, but to contain a core or nucleus of a white or gray mineral which, as above noted, has, on casual inspection only, been mistaken for the ordinary dolomite of the quarry. There is no

*Trans. Roy. Soc. of Canada, vol. 1, also Min. Physiology and Physiography, p. 434.

constant relationship in thickness between the serpentine and the nucleus, the coating varying from the fraction of one to several inches (rarely more than 5 or 6) in thickness. Figs. 1, 2, and 3, Pl. XXXI, are characteristic forms, the nodule shown in fig. 1 having been broken so as to leave the nucleus entire, while figs. 2 and 3 are from specimens cut through the center and polished. In fig. 1 the nucleus is about 11 inches long and 5 inches wide by 2 inches thick in its greatest dimensions, tapering down to a blunt point at the left. Larger were found, and others in which the nucleus had completely disappeared. Not the least interesting feature of the case was the discovery that these nuclei varied in color, some being gray, slightly greenish, others pure white, and that each had a coating of serpentine characteristic of itself. That surrounding the gray nuclei is deep, bright green, sometimes almost black, and scarcely translucent; that surrounding the white nuclei, on the other hand, is of a beautiful light oil yellow, almost amber color, and translucent almost to transparency. The two varieties are in most cases distinct, rarely, so far as observed, grading into one another. Both varieties show at times narrow veins of amianthus or chrysotile, though these are most abundant in the light-colored variety. On exposure to weather, after quarrying, a shrinkage takes place, so that in most cases the serpentinous crust shells off only too readily, in small fragments, and often almost as clean as the burr from a chestnut, leaving the nucleus compact and fresh, with a firm, smooth and shining surface, and with only thin patches of serpentine adhering here and there, as in fig. 1 of plate.

On examination with a pocket lens it becomes apparent that the connection between the serpentine coating and the nuclei is much closer than at first appears, the mineral of the nuclei near the point of contact assuming a faint yellowish or greenish tint. Small veins and tongues of serpentinous matter also in places project into the nuclei, as shown in figs. 2 and 3 of plate, where the light gray mineral of the nucleus shows up in strong contrast with the dark serpentine. Thin sections cut so as to include portions of both serpentine and nucleus show the latter to consist of a granular aggregate of short and stout crystals of all sizes up to 2^{mm} in diameter, colorless or slightly gray, and non-pleochroic though polarizing brilliantly in yellow, green, and violet colors. The mineral is monoclinic in crystallization, gives extinction angles on sections approximately parallel to the clinopinacoid, varying from 27° to 36°, and shows the optic axes in the plane of symmetry. Well-defined prismatic cleavages are developed, which, as seen in basal sections, cut one another at nearly right angles. A third cleavage parallel to the orthopinacoid was observed in a few instances. Polysynthetic twining is common; twin lamellæ, as shown in basal sections lying parallel with the orthopinacoid. All the above characteristics are indicative of diopside. These indications are confirmed by the analyses to be noted later. Examination of portions of the sec-

tions from the line of contact show most beautifully the direct transition of the diopside into serpentine, as illustrated in figs. 1 and 2, Pl. XXXII, engraved directly from photomicrographs by Mr. T. W. Smillie. Each crystal is bordered by a narrow fringe of parallel-lying serpentine fibers standing at right angles with the crystal itself, after the manner so well known in serpentine pseudomorphs as to need no further description. Fracture and cleavage lines have given way to irregular canals of serpentinous matter, and every gradation can be traced in a single section from the fresh diopside to pure, compact serpentine. Secondary minerals (other than serpentine) are surprisingly rare in the sections at hand. In all those from the larger masses the gray pyroxene is seen passing directly into pure serpentine without a trace of admixtures of free calcite, silica, or iron oxides, all having evidently been removed as fast as formed. (See fig. 1.) In some instances where the pyroxene occurs in nodules but a few millimeters in diameter inbedded in the dolomite the transition into serpentine is made noticeable by the formation of a reddish zone of iron oxides. Sections from the white pyroxene differ in that they still show in the form of small calcite granules the excess of lime set free during the process of transformation. (See figs. 2 and 3.) As both pyroxenes contain essentially the same percentages of CaO such differences can scarcely be expected to prove constant on further investigation. Even where the alteration is complete and no trace of the original pyroxene remains, the origin of the serpentine by hydration of some magnesian silicate is made at once apparent by such appearance as shown in fig. 4, Pl. XXXII. Here the gradual increase in bulk of two adjacent granules of the pyroxene has crowded the calcite grains lying between them into a compact bundle, while immediately beyond they spread out into broad fan shaped areas, giving rise to a pseudo fluidal structure. These evidences of expansion suggest a possible explanation of the slickensided surfaces seen on all the nodules, and which indeed are common to serpentinous rocks wherever found, and emphasize the suggestion made by Diller* and others to the effect that they are due chiefly, if not wholly, to motion generated in the mass of rock by increase in volume. Take the case of an original nodule of the pyroxene imbedded in the dolomite. As hydration goes on more space is demanded and the serpentinous matter is pushed out into every available nook and crevice. Possibly through force of expansion fractures will be formed in the inclosing rock, and as the serpentine is pushed out gradually into these spaces it comes in contact with the rough walls of the inclosing rock, and is grooved and polished in direct proportion to the amount of movement and the hardness and resistance of the material of which it is composed. The extreme compactness of the serpentine is doubtless due largely to the resistance to expansion offered by the dolomite in which it is imbedded.

* Geology of Lassen's Peak District, California. Eighth Annual Report U. S. Geological Survey, 1886–'87. MSS. notes.

Nov. 8, 1888.

Just what the amount of expansion has been can not be estimated absolutely, owing to a loss of an undeterminable amount of material. From a comparison of specific gravities of the two minerals alone it would appear that this increase was about 29 per cent. This, however, can not be considered as more than a rough approximation, since, as shown by the analyses to be noted later, there has been a loss of all the lime and presumably of a part of the silica with smaller amounts of iron oxides and alumina.* I am of course aware that as long ago as 1872, J. Lemberg† in describing the highly lustrous and slickenside-like surfaces of certain serpentinous rocks, argued from facts, not necessary to repeat here in full, that their lustrous appearance was due not to movement nor pressure, but to a deposit on the surface of an infinitesimally thin coating of a magnesian silicate. Proof of this was drawn mainly from the fact that the luster appeared not merely on joint surfaces but also on cleavage faces and rough uneven surfaces where there had evidently been no movement. Further, when, as sometimes occurred, a polished serpentinous surface was in contact with limestone, it was the serpentinous rock alone that showed the polish while the limestone remained rough and unchanged. The two cases are not, however, exactly parallel. In the present instance fractured surfaces of the serpentine show frequently a highly lustrous surface, almost resembling a true cleavage, which may very likely be due to the thin coating or glazing suggested by Lemberg. The lustrous condition of the exterior of the nodules can not, however, be thus accounted for. Not merely are they polished, but also are grooved and striated like bowlders from glacial drift; further, this outer portion shows often in places a thinly laminated or platy structure, recalling the platy structure produced in metals by continuous hammering. I believe this condition to have been brought about wholly by pressure and motion generated in the mass itself by increase in bulk rather than by orographic movements. The fact that the inclosing dolomite does not show like polished surfaces may be due simply to the fact that during the molecular re-arrangement incident to the conversion of the diopside into serpentine, and its highly hydrated condition, this mineral would naturally be in a condition to be molded and scratched by the dolomite, even were not the latter under ordinary circumstances the harder mineral of the two.

To further show the relationship between the two minerals, samples of both pyroxenes and serpentines were submitted to Mr. Charles Catlett, of the U. S. Geological Survey, for analysis. The results are as follows:

---

*Dr. Hunt (Min., Phys., etc., p. 506) has shown that the conversion of olivine into serpentine, if unattended by loss of silica, is attended by augmentation in bulk amounting to 33 per cent.

†Ueber die contactbildungen bei Predazza. Neues Jahrbuch, Vol. XXIV, p. 187.

	I.	II.	III.	IV.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
SiO_2	51.45	40.23	54.215	42.38
MgO	18.43	39.46	19.82	42.14
CaO	24.02	....	24.71	....
Al_2O_3	2.94	2.18	.59	.07
Fe_2O_3	1.06	4.02	.20	.97
FeO	.96	trace	.27	.17
MnO	trace.	....	....	....
SO_3	trace.	....	....	....
Ignition	1.08	14.24	.14	14.12
	99.94	100.13	99.945	99.85

I. The gray pyroxene. II. The green serpentine resulting from its alteration. III. White pyroxene, and IV, the yellow serpentine resulting from its alteration *

The changes which are shown to have taken place are self-evident and need not be commented upon. The fact that no free silica or secondary silicates other than serpentine are found in the sections may be due to the entire removal of the excess silica in the pyroxene, as was the case with the calcite, or as seems very probable, the inclosing dolomite may also have been acted upon and yielded sufficient magnesia to convert the whole into serpentine as suggested by Dana† in the case of the serpentine and dolomite of Westchester County, N. Y. In their high percentages of water it will be observed these serpentines approach closely to the so-called retinalite variety as given by Dana.‡ The extreme compactness and homogeneity of the Montville stone, however, will scarcely permit us to consider it as a mixture of deweylite and serpentine as suggested by Professor Dana in the case of the retinalite of Grenville, Canada. Secondary minerals other than serpentine and calcite are, however, by no means wholly lacking. In many cases the granules of the light yellow serpentine (No. IV of analysis) are bordered by a finely microcrystalline, creamy white, somewhat chalky looking mineral, which I have not been able as yet to obtain in sufficient purity for accurate determination, but which is judged to be a mixture of calcite and magnesite. Aside from this are occasional aggregates of a white color, and with a compact microgranular or short fibrous structure which under the microscope are seen to consist of a dense aggregate of minute calcite granules associated with numerous elongated silky fibers scarcely affecting polarized light but giving extinctions always parallel with their greatest elongation. The entire mixture submitted to Mr. Catlett for analysis yielded results showing it to consist of 90.17 per cent. mixed carbonates of lime and magnesia (mostly lime) and 9.97 per cent. of a mineral having essentially the composition of serpentine with traces of iron oxides, alumina, soda, and potash. It is evident that the fibrous

* Analysis of serpentine from this same locality, as given by Dana (System of Mineralogy p. 467) is as follows: SiO_2 42.5; MgO 42.16; H_2O 14.22; FeO 1.96. This, it will be noted, agrees almost exactly with the above No. IV.

† Am. Jour. Sci., July, 1880, p. 32.

‡ System of Min., p. 467.

mineral is simply fibrous serpentine (chrysotile). The compact, light yellow platy mineral coating the surface of the nodule to which I have already alluded is found, on pulverizing and treatment with dilute acid, also to be a mixture of calcite and soft silky fibers of like nature. As already intimated, I am disposed to consider this structure to have been induced wholly by pressure. In the quarry dump were found fragments of the rock, showing aggregates of serpentine, a very compact light greenish amorphous mineral resembling deweylite, but with a specific gravity of 2.5, small scales of deep reddish-brown and nearly colorless mica, very compact aggregates of a greenish micaceous mineral with the blow-pipe properties of vermiculite and other minerals, which for lack of time and a sufficient amount of satisfactory material must be left for future investigation. The secondary calcite, I should say, is usually granular and of a slight bluish tinge. The mineral is, however, sometimes found in fibrous form and of a pure white color.

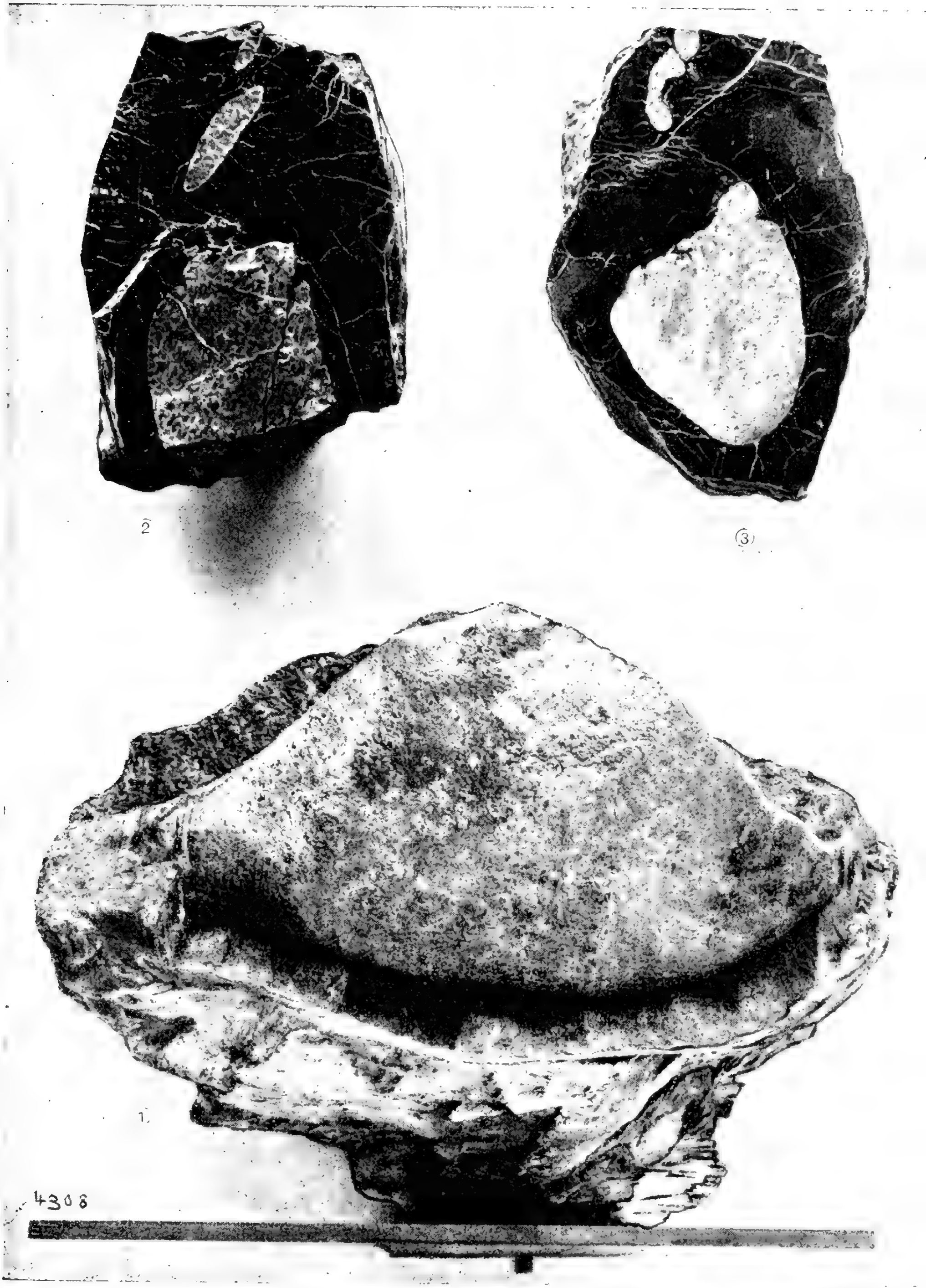
In conclusion: The Montville serpentine is a highly hydrous variety, approaching retinalite in composition, and was derived by a process of metasomatosis* from a mineral of the pyroxene group with the optical and chemical properties of diopside. The change has been accompanied by a considerable increase in bulk, and in most cases the production of beautiful slickensided surfaces and a platy structure due to pressure. The excess of lime has recrystallized chiefly as granular calcite of a light bluish tinge, and also in fibrous forms. Other secondary minerals have been found in the quarry dump, but not having been found in place have not been worked out genetically.

No free silica in the form of chalcedonic veins, such as are an almost universal accompaniment of altered beds of dunite, have been found. It is inferred that sufficient magnesia must have been furnished from other sources to convert the whole into serpentine, or that farther search will bring to light secondary silicate minerals. Concerning the exact relationship existing between the pyroxene masses and the dolomite, I am somewhat in doubt, as the outcrops were poor at the points visited and the time limited. They are apparently segregations, and certainly can not be considered in any way connected with igneous agencies. A very small dike (less than a foot in width) of a dense, nearly black trap rock occurs at the quarry opening, but apparently is in no way connected with the processes of serpentinization. I presume this is the rock described as a porphyrite by Mr. Kemp in the annual report of the State Geologist of New Jersey for 1886 (p. 111).†

The derivation of serpentine from pyroxene is a matter well known to

* I use this word to indicate the process of "indefinite substitution and replacement:" the sense in which it has already been accepted by Dr. Hunt (Min. Phys., p. 430), Emmons, and others.

† It may be well to state that the quarry is the property of Mr. J. J. Gordon, of Boonton, and can be at present easiest reached by rail from New York City to Boonton and thence by carriages. The writer would here express his thanks to Mr. Gordon for his kindness in accompanying him to the quarry and forwarding desirable material.

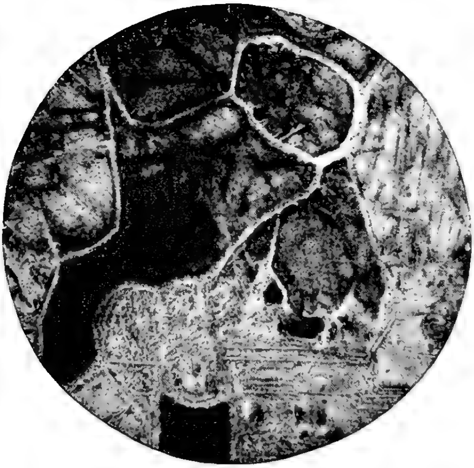


SERPENTINE OF MONTVILLE, NEW JERSEY.—NODULES OF SERPENTINE WITH NUCLEI OF DIOPSIDE.

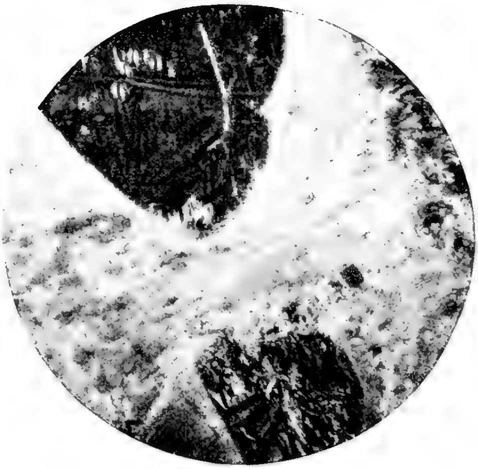
(Explanation on page 111.)

1.

2.



3.



4.

SERPENTINE OF MONTVILLE, NEW JERSEY.—PHOTOMICROGRAPHS SHOWING STAGES OF TRANSITION FROM DIOPSIDE TO SERPENTINE.

(Explanation on page 111.)

petrographers. I have gone so much into detail in the present case for several reasons. The resultant serpentine is of rare beauty and purity, and is therefore much sought for by collectors in general. The possibility of obtaining readily hand specimens which show the abrupt transition within the space of one or two centimeters from pure, unchanged pyroxene to clear, compact serpentine of almost ideal purity, makes the material especially valuable to teachers. I am, moreover, inclined to the belief that future investigation will show very many occurrences of small detached masses of serpentine included in calcareous or schistose rocks to be of similar origin. Indeed, Dr. Hunt,* in arguing against the theory of the intrusive origin of serpentinous rocks, so describes certain localities as to leave almost no doubt that this is the case. He says (p. 435): "In these (the Laurentian gneisses, crystalline limestones, etc.) the serpentine is often disseminated in grains or small irregular masses, giving rise to the varieties of so-called ophicalcite. These imbedded masses of serpentine are sometimes concretionary in aspect and may have a nucleus of white granular pyroxene. They often recall in their arrangement embedded chert or flint, and, like it, sometimes attain large dimensions." Dr. Hunt seems, however, to have regarded the serpentine in all these cases as a chemical deposit about the nucleus, instead of a metasomatic product.

It would seem to the writer, further, that the importance of the movements generated by an increase in volume by any large mass of olivine, pyroxene, or other magnesian silicates in passing into serpentine has not received its full share of attention. May it not be that very many of the slickensided surfaces and local displacements which often prove so misleading when studying rocks undoubtedly stratified, are due wholly or in a large part to this agency?

NATIONAL MUSEUM, *May* 20, 1888.

EXPLANATION OF PLATE XXXI.

MONTVILLE SERPENTINE.

Nodules of serpentine with nuclei of diopside; Figs. 2 and 3 showing cut and polished surfaces. The light gray is the unchanged diopside; the dark, the secondary serpentine. Fig. 1 shows a nodule from which a portion of the serpentinous crust has been removed, showing the ham-shaped nucleus. This figure shows also on the lower edge the laminated or platy structure mentioned on page 108.

EXPLANATION OF PLATE XXXII.

MONTVILLE SERPENTINE.

Photomicrographs showing the various stages of transition from diopside to serpentine. Fig. 1 shows the direct transition of the gray diopside in the upper right side of figure into clear compact serpentine. Figs. 2 and 3 show the transition of the white diopside into serpentine, with separation of calcite and the undetermined creamy white mineral mentioned on page 105. In both figures this mixture of calcite and the creamy white mineral is shown by the irregular dark areas in the lower part of the field. Fig. 4 shows the crowding together of the calcite into a compact bundle by the expansion of two granules of serpentinized diopside.

*Min. Physiology and Physiography.

DESCRIPTION OF A NEW PIGEON FROM GUAYAQUIL, ECUADOR.

BY ROBERT RIDGWAY.

Columba guayaquilensis, sp. nov.

SP. CHAR.—Similar to *C. albilinea* Bp., but smaller and much darker; the under tail-coverts deep purplish gray, like flanks. Wing 7.70–7.90, tail 5.50–5.70, culmen .60, middle toe 115–125.

Type, No. 101311, Guayaquil, Ecuador, 1884; Dr. William H. Jones, U. S. Navy.

NOTES ON THE EUROPEAN CRESTED TITMICE.

BY LEONHARD STEJNEGER.

The direct comparison of three Scandinavian examples with a series from Central Europe reveals a difference in the coloration of the Crested Titmice from these localities, which necessitates their separation.

The three birds from Norway and Sweden agree completely *inter se* on one hand, and so do the German and Hungarian specimens on the other. The former are grayer above, the latter more brownish, but the exact shade is very difficult to describe. Consulting Ridgway's "Nomenclator of Colors," pl. iii, I should say that the northern examples have the back "Isabella" gray, while those from the South are "wood-brown" gray. The difference in the coloration of the flanks is of the same kind but even more striking, for here the gray ground color is absent and the flanks are therefore, respectively, "Isabella colored" and "wood-brown" without further qualification.

It is curious that the difference between these forms has been overlooked by most ornithologists, since they are quite as distinct as are *Sitta cæsia* and *Sitta europæa*.

As to the name of the Crested Titmice, the case is identical with that of the two Nuthatches just referred to. The name given by Linnæus will have to be reserved for the Scandinavian form, which will stand as *Parus* (or *Lophophanes*) *cristatus* LINN. The appellation *Parus mitratus*, which Brehm, in 1831, bestowed upon an alleged form of the Central European bird, seems available for the German and Hungarian race. Intergradation being the test for the use of trinominals I defer calling the bird in question *Parus cristatus mitratus* until the intergradation shall have been fairly proven, if in reality it does exist.

It would be very interesting to know whether the Crested Titmouse which inhabits Scotland belongs to either of the two forms indicated above, or whether it shows any peculiarity of its own entitling it to separate recognition. British ornithologists not prejudiced against possibilities of this kind ought to look into the matter.

Measurements of Parus cristatus.

U. S. Nat. Mus. No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Bill from nostrils.	Tarsus.	Middle toe with claw.
113227	....	♀ ad.	Bergen, Norway ...	Aug. 18, 1887	61	48	7.5	18.5	14
113228	....	♀ ad.	......do	Sept. 18, 1887	64	51	8	18	......
111401	5546	♂ ad.	Vermland, Sweden ..	Mar. 6, 1882	60	50	8	......	......

Nov. 8, 1888.

Measurements of Parus mitratus.

Museum and No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Bill from nostrils.	Tarsus.	Middle toe with claw.
U. S. Nat., 9220	v. Müller	♂ ad.	Nuremberg, Germany.	Jan. 14, 1848	63	50	7.5	19	.....
U. S. Nat., 105370	....	♂ ad	Moravia, Austria.	....	68	56	8	19	.....
U. S. Nat., 105371	....	♂ ad.	Silesia, Germany.	Sept. 20, 1882	64	51	8	19	15
U. S. Nat., 69975	Burchard	♀ ad.	Rostock, Germany.	....	63	51	7	19	15.5
U. S. Nat., 56530	Schlüter, 553	♀ ad.	Saxony, Germany.	....	65	50	8	.....	.....
U. S. Nat., 111402	Madarasz	♀ ad.	Hungary	Oct. 15, 1884	64	53	7.5	18	.....
U. S. Nat., 111400	... do	♀ ad.	Oravitz, Hungary.	Sept. 16, 1883	63	49	7.5	18	14
U. S. Nat., 111403	... do	ad.	... do	Oct. 4, 1883	65	52	8	19	15
Am. Mus., N. Y., 234	Max	♂ ad.	Neuwied, Germany.	....	63	50	8	.....	.....
Am. Mus., N. Y., 235	... do	♀ ad.	... do	....	63	47	8	.....	.....

ON NEPHRITE AND JADEITE.*

BY F. W. CLARKE AND G. P. MERRILL.

(With Plate XXXIII.)

In the ethnological collections of the U. S. National Museum there are many objects of jadeite, nephrite, and of various jade-like stones. They represent a wide range of localities, especially as regards the North American specimens; and in their external characteristics they exhibit great variety in color, texture, and quality. Some came from regions which have already been well studied; but others, as in the series of objects from Alaska and Costa Rica, seemed to merit additional investigation; and at the earnest desire of the late Professor Baird we undertook their mineralogical description. With anthropological questions we have had nothing to do; in each case the nature and character of the material has been our sole study.

In Alaskan specimens the Museum is, as might naturally be expected, particularly rich. Since the acquisition of that Territory by the United States, it has been visited by many official expeditions, and their assembled collections represent the entire coast line from Point Barrow to its southernmost extremity. If we except the remarkable hammers of jade-like pectolite from Point Barrow described by one of us some years ago,† all of the Alaskan jades are true nephrites, indistinguishable in most particulars from the nephrites of Siberia, New Zealand, or the Swiss Lake dwellings. In general terms this nephrite is coarse in quality; but occasionally objects are seen having high finish, some translucency, and great beauty. Of course such objects could not be sacrificed to so destructive an investigation as ours, even though we endeavored to injure specimens as little as possible. In each case in which analysis seemed desirable the necessary material was carefully sawed off, and as little was taken as would suffice for our purposes. The following objects were more or less fully examined by us:

43415. Part of adze, Cape Prince of Wales.
43440. Material for drill, St. Michaels.
44606. Knife-sharpener, Cape Nome.
44920. Knife-sharpener, Sledge Island.
44921. Knife-sharpener, Sledge Island.
44922. Knife-sharpener, Sledge Island.
63715. Stone implement, Diomede Island.
63733. Small knife, Diomede Island.
63762. Sharpening tool, Hotham Inlet.
89622. Knife-sharpener, Point Barrow.
89658. Stone adze, Point Barrow.

---

* In this investigation the chemical work is entirely due to F. W. Clarke, and the microscopic work to G. P. Merrill.

†Clarke, Amer. Jour. Sci., 1884.

Of these the last two were collected by the Signal Service expedition commanded by Lieut. P. H. Ray; the others were received from Mr. E. W. Nelson. For each specimen the specific gravity was carefully determined by Dr. William Hallock, of the U. S. Geological Survey. The general description of the material may be summarized thus:

43415. Yellowish-green, mottled, sp. gr. 2.989.
43440. Siskin-green, translucent, uniform sp. gr. 3.006.
44606. Olive-green, sp. gr. 2.988.
44920. Olive-green, mottled, sp. gr. 2.928.
44921. Olive-green, mottled, darker, sp. gr. 2.921.
44922. Superficially black, sp. gr. 2.963.
63715. Siskin-green, translucent, sp. gr. 3.002.
63733. Blackish green, mottled and laminated, sp. gr. 3.010.
63762. Olive-green, mottled and laminated, sp. gr. 2.975,
89622. Olive-green, translucent, sp. gr. 2.978.
89658. Nearly black superficially, sp. gr. 2.922.

Of these, Nos. 43415, 43440, 63733, and 89658 were selected for analysis and microscopic study. The following table gives the results of the analyses:

	43415	43440	63733	89658
Ignition	1.91	1.42	2.03	2.06
Silica	56.01	56.12	56.08	57.11
Alumina	1.98	.63	1.01	2.57
Ferrous oxide	6.34	7.45	7.67	5.15
Maganous oxide	trace.	trace.	trace.	trace.
Lime	12.54	12.72	13.35	11.54
Magnesia	21.54	20.92	19.96	21.38
	100.35	99.26	100.10	99.81

In each case the ferrous oxide represents the total iron. Ferric oxide was not discriminated, nor were alkalies looked for. So far, then, the analyses are imperfect.

In addition to the above-named implements, another object of supposed jade was investigated. It was a flaker (No. 89624) from Point Barrow, of dull bluish green color, conchoidal fracture, considerable translucency, and specific gravity 2.654. These data, together with a partial analysis, identify the specimen as quartz. It contained 97.79 per cent. of silica.

Before going on with the discussion of the microscopic character of the jades another series of specimens remains to be noticed. As regards origin, some early writers have attributed the Alaskan nephrite to Siberian sources, but of late years it has been generally ascribed to a home locality. Native reports pointed to a source known as the Jade Mountains, north of the Kowak River, about 150 miles above its mouth; and after several attempts the spot has been actually visited by Lieut. G. M. Stoney. He collected specimens of jade *in situ*, and a number of samples were submitted to us for examination. They may be described as follows:

A. Greenish gray, splintery, lamellar in structure,

B. Like A, but more granular.
C. Paler, nearly white, closer grained.
D. Brownish, highly foliated.
All four were analyzed with the subjoined results:

	A.	B.	C.	D.
Ignition	1.78	1.38	1.76	1.73
Silica	58.11	55.87	56.85	57.38
Alumina	.24	2.07	.88	.19
Ferric oxide	5.44	5.79	4.33	4.43
Ferrous oxide	.38	.38	1.45	1.25
Manganous oxide	trace.	trace.	trace.	trace.
Lime	12.01	12.43	13.09	12.14
Magnesia	21.97	21.62	21.56	22.71
	99.93	99.54	99.92	99.83

Studied in thin sections, under the microscope, the Alaskan nephrites present the following characteristics:

A. This sample, as seen in the slide and by ordinary light, presents a uniformly colorless field of a homogeneous, non-pleochroic mineral, and is transversed by fine wavy rifts running all in the same general direction. The inclosures are very minute, some are mere dust-like particles, others are distinctly recognizable as limonite. Between crossed nicols the entire field is covered with very indefinitely outlined areas, which are alternately light and dark as the stage is revolved. With a power of two hundred and thirty diameters these areas are seen to be composed of wavy and uneven scales and bundles of fibers so interwoven and confused that no trustworthy measurements of extinction angles are obtainable. Many of the bundles seem to extinguish in directions approximately parallel with their length; but others show wide angles. The worked jade, 43415, from Cape Prince of Wales, has essentially the same structure as A, and needs no separate description. No. 43440, from St. Michaels, is also quite similar. In this specimen the fibers are short and scale-like. There are no inclosures of note, although there is a plentiful sprinkling of amorphous dust-like material. No. 63733, from Diomede Island, is also much like A. It presents no difference which can be considered mineralogically essential, but the texture is more uneven, and many of the fibrous tuft-like masses are larger. The variations, however, are no greater than might occur in samples from the same mass.

B. This specimen in thin sections and by ordinary light is also almost colorless, or very faintly greenish, and without pleochroism. It shows only a few yellowish and opaque inclusions, which are evidently of a ferruginous nature. Between crossed nicols it exhibits the well-known nephritic structure—a dense aggregate of short fibers and scales, the fibers arranged in clusters, or radiating tuft-like bundles, without definite boundaries, which merge into one another as the stage is revolved. In cases where the bundles are composed of fibers lying approximately

parallel, angles of extinction were measured varying from 0° to 15°. The structure may be best understood by reference to fig. 2. It corresponds quite closely with a nephrite from the Belaja River, in Siberia, as described and figured by Beck and Muschketow,* but it is more uniform in texture, and resembles more nearly the jade from New Zealand. (See also figs. 1 and 3.) The Point Barrow specimen, 89658, has the same structure as B, and needs no further description.

The foregoing evidence is sufficient to show the essential identity of all the Alaskan jades, and to dispose of the theory that their presence in Alaska is to be accounted for upon the basis of trade with Siberia. That theory is also negatived by the discovery, announced by Mr. G. M. Dawson,† of small nephrite bowlders on the upper part of the Lewes River, not far from the eastern boundary of Alaska. But these nephrites are also strikingly like those from many other localities, and two of the latter have been included in our comparisons. First, a waterworn, dark-green bowlder from New Zealand, sent to the Museum by Sir Julius Haast; and second, a small implement from Robenhausen, Lake Pfäffikon, Switzerland, out of the collection of Mr. Thomas Wilson. The latter specimen, also green, had a specific gravity of 3.015, as determined by Dr. Hallock. The analyses are as follows:

	New Zealand.	Swiss.
Ignition	.83	.63
Silica	56.73	56.87
Alumina	3.22	1.50
Ferrous oxide	5.96	6.33
Lime	13.24	13.45
Magnesia	19.42	21.06
	99.40	99.84

All the iron is represented here as ferrous. Traces of manganese were present, but alkalies were not looked for.

In thin section, under the microscope, the Robenhausen jade is seen to be made up of an extremely fine and compact aggregate of fibers, scales, and tufts, all arranged with their longer axes approximately parallel, so as to produce a more or less schistose structure. Sections cut parallel to this schistosity exhibit, in ordinary light, colorless, elongated, narrow areas, bounded by very irregular wavy lines which a high power shows to be rifts stained by impurities. Between crossed nicols the entire field is converted into a confused mass of brilliantly polarizing fibers, from which no measurement of extinction or cleavage angles are obtainable. Cross sections show a peculiar felt-like groundmass of colorless particles, polarizing only in light and dark colors, and blending into one another without definite lines of demarkation when the stage is revolved. The field shows numerous larger elongated areas,

* Ueber Nephrit und seine Lagerstatten, p. 12, Fig. 1.

† Science, April 20, 1888, p. 186.

lying with their longer axes parallel, which give extinctions nearly, if not quite, parallel with those axes. Except so far as to show the homogeneity of the mineral, the optical examination is quite unsatisfactory.

The New Zealand jade, as seen under the microscope, consists wholly of a very compact aggregate or felt-like mass of confused scales and minute fibers, arranged in bundles and tufts in a manner which can be best understood by a reference to fig. 1. The dark interstitial portions there shown are, when the stage is revolved and the nicols are crossed, seen to be composed of fibers and tufts of the same character as the lighter parts. In ordinary light these are almost perfectly colorless, and not perceptibly pleochroic. Between crossed nicols they show brilliant polarization in yellow, red, and purple colors. The fibrous, bent and tufted form of the mineral renders a determination of its optical properties difficult, and in many cases impossible. In the few instances that they are gathered into long bundles in which the fibers are lain approximately parallel, they are found to give extinction angles varying from 0° to 20°, indicative of a mineral of the amphibole group—an indication fully borne out by the analysis. The only inclosures are minute, dust-like particles of a black or yellow color, evidently ferruginous, but which a power as high as 750 diameters fails to satisfactorily determine. This structure is identical with that shown by slides in the museum collection made from jade implements from New Zealand. Jade from the same locality has also been studied by Arzruni,* who describes it as an extraordinarily dense mass of bent and contorted fibers, stained yellowish in spots by iron oxide, and without inclosures. Our analysis agrees sufficiently well with that of Mr. C. L. Allen† of a jade from the same locality, to insure identity of material.

The same structure, with slight modifications, is common to the nephrites of New Caledonia and Siberia, as shown by sections of them in the Museum collection. Indeed, this finely fibrous and tufted structure appears to be characteristic of true nephrite, from whatever locality. Thus, Arzruni‡ describes a nephrite from southeastern Alaska as possessing a microscopic structure uniformly fine and fibrous throughout. The fibers, though but little bent and curved, seldom lie parallel with one another, but are grouped into loose, irregularly-outlined, and tufted bunches. In the less compact portions the fibers intersect each other at approximately right angles, forming a grate-like, reticulated structure. This he regards as a commencement of alteration into what may be serpentine or bastite. Such an alteration is accompanied by a slight browning of color, due to the liberation of iron oxide. He regards the isolated fibers as a variety of amphibole, and compares the general structure with that of a nephrite from the Kitoj River, Irkutsk, Siberia, which has been described by Beck and Muschketow, and which will be noted later. He states, however, that it differs from the Siberian

* Zeit. für. Ethnologié, 1883, p. 183.

† Chem. News, 1882, p. 216.

‡ Jahresbericht des Vereins f. Erdkunde zu Dresden, 1885, p. 6.

nephrite in that the latter has its fibers finer and grouped in long bunches, or in spreading tufts, as shown in our fig. 3. Such, however, may be mere local variations; and a more weighty distinction is based upon the presence of inclosures of foreign matter in the Siberian nephrite which are quite lacking in the specimens from Alaska. The analysis given by Dr. Meyer in this paper, although differing somewhat from that of our series, is sufficient to insure identity of material.

Beck and Muschketow* describe the Kitoj River nephrite as dark leek-green in color and of a lamellar structure.

Sections cut parallel and at right angles with the lamination show in the one case a prevailing confused fibrous and parall l fibrous ("verworren-faseriges u. parallel-faseriges") structure, and in the other a microgranular and lamellar structure. Under a power of ninety-five diameters and in ordinary light the section is traversed by clear colored veins, which stand out boldly from the surface when the nicols are crossed. These are bordered by extremely fine fibers arranged both parallel and at right angles with the veins, and show by their aggregate polarization and optical behavior that they are asbestus. This structure is shown only in sections cut parallel with the lamination. The Belaja River nephrite is described by the same author as showing under the microscope a confused fibrous aggregate of extremely fine needles of various sizes, the larger some 0.0043^{mm} in thickness, and, with a length many times greater, rarely a thickness of 0.04^{mm} is attained. The fibers are extraordinarily confused and without the slightest regularity in their arrangement, though in some cases an approximately parallel arrangement occurs which gives rise to a pseudo-microfluidal structure. More commonly the fibers are found in tufts, radiating from a common point, "*Strahlenartig*." In consequence of the homogeneity of the aggregate it is assumed that the fibers belong all to the same mineral species. Inclusions are abundant. Limonite is the most common, occurring as small black points, and often staining the adjacent needles a brown color. This coloring matter sometimes segregates into veins of sufficient size to be apparent to the unaided eye. Other dark inclosures are believed to be chromite. As in the last case, sections at right angles to the lamination show a less pronounced fibrous structure, but are rather microgranular. Still another nephrite from the Bustraja River has the fibers so extremely small that a great number could be seen (when magnified five hundred diameters) grouped in a space 0.0043^{mm} in breadth. These asbestus-like fibers are regarded as secondary, as are also small colorless sections with which they are sometimes associated, and which from their optical behavior are supposed to be serpentine. A nephrite from the Caucasus has similar properties. One from the Jarkand Valley in Turkestan differs from the last in carrying a considerable number of magnetite inclosures which are visible to the naked eye. Its microstructure greatly resembles that

*U. Nephrit u. seine Lagerstätten. Verhand. der Kaiserlichen Min. Gesell. zu St. Petersburg: II series, XVIII.

of the Siberian nephrites, but presents certain peculiarities. The groundmass has a like microgranular and fibrous structure, but sections cut at varying angles with the apparent schistosity show no such separation between the granular and fibrous parts as was observed in the Siberian stone. These structures are shown in figs. 3 and 4, Pl. I, of their paper. They think to distinguish between the Jarkand and Siberian nephrites by their inclosures of foreign particles. In all Siberian nephrites the iron occurs in the form of limonite or chromite, while in those of Jarkand it occurs wholly as magnetite and hematite. These differences are shown by analysis. Another marked difference lies in the irregular massive aggregates sometimes occurring in sizes up to 0.05^{mm}. These from their optical and cleavage properties are judged to be diopside. A nephrite from Samarkand showed inclosures of a similar nature.

The distinction given in the résumé by these authorities, between the Siberian and Turkestan nephrites, are that the first named show a clear microschistose structure with inclosed grains of chromite and limonite; while the last named is massive, with very few inclosures of ferruginous granules, but in place of these characteristic inclusions of diopside or a closely related mineral. A nephrite from Pekin was found to possess all the microscopic properties of that from Jarkand. The microscopic examinations of Messrs Beck and Muschketow were in all cases accompanied by chemical analyses, and the paper as a whole forms a most important addition to the literature of the subject.

Mr. Otto Schœtensack,* in a paper on the subject, describes a nephrite from the Tienshan Mountains of a dark green color and specific gravity of 2.98, which shows between crossed nicols a fine crystalline texture, with many included asbestus-like fibers, giving extinction angles varying from 12° to 16°. Rarely are seen concentric aggregates of fine bent fibers. Strongly dichroic, yellowish brown and yellowish green granules are supposed to be epidote. Another nephrite from Khoten in Bokhara, with a specific gravity of 2.947 and of a violet-gray color, shows between crossed nicols a confused, short fibrous texture, with the fibers but slightly bent, through which are distributed large crystalline areas in which the fibers are much more contracted. This is apparently the same structure as shown in some Siberian nephrites by Beck and Muschketow.

Of jade objects from Mexico the National Museum has a large and fine series, but nearly all the specimens are from the one State of Oaxaca. The greater number of them consist of true jadeite; but as jadeite from the same region has been described by Damour,† a very exhaustive review of the material did not seem to be necessary. A good series of specific gravity determinations was, however, made by Dr. Hallock, and

*Die Nephritoide des mineralogischen u. d. ethnographisch-prähistorischen Museums der Universität Freiburg im Breislau. Inaug. Dis. Berlin, 1885.

†Bull Soc. Min., IV, 157.

two specimens were also submitted to chemical and microscopic study. The following objects were examined:

1. Bead of light color, mottled with emerald green. Blake collection, No. 127. Weight 12.81 grammes, specific gravity 3.007.

2. Head, light green, from Zaachita. Aymé collection, Museum number, 115213. Weight 21.517 grammes, specific gravity 3.190.

3. Dark, dull green, translucent amulet. Blake collection, No. 79. Weight 131,695 grammes, specific gravity 3.332.

4. Human figure, light greenish, finely polished. Blake collection, No. 35. Weight 68.409 grammes, specific gravity 3.152.

5. Head and bust, dull opaque green. Blake collection, No. 77. Weight 186.627 grammes, specific gravity 3.338.

6. Face with head gear and pendants, light emerald green, grayish back. Blake collection, No. 38. Weight 30.274 grammes, specific gravity 3.232.

7. Head with grotesque mask, dark opaque green. Blake collection, No. 36. Weight 47.432 grammes, specific gravity 3.087.

8. Serpent head, translucent, mottled green. Blake collection, No. 37. Weight 39.09 grammes, specific gravity 3.337.

9. Ring, pale opaque green, near No. 4. Blake collection, No. 25*a*. Weight 791 grammes, specific gravity 3.199.

10. Celt-like object, blackish green, from Cholulu. Blake collection, No. 54*d*. Weight 293.91 grammes, specific gravity 3.355.

11. Rude, squarish head, light green. Scratched by steel. No number nor locality. Weight 70.54 grammes, specific gravity 2.758.

12. Light green jadeite amulet, highly polished. Aymé collection, No. 105. Weight 100.365 grammes, specific gravity 3.337.

13. Whitish, mottled human figure, dull polish, opaque. From San Martin Mexicampas. Aymé collection, No. 401. Museum number, 115236. Weight 103.78 grammes, specific gravity 3.021.

The specific gravity of several other Mexican jadeites in the Museum collection was determined several years ago by the late G. W. Hawes. As the data are unpublished they may fairly be inserted here:

Mus. No. 7844. Polished grayish green hatchet. Granular texture, specific gravity 3.34.

Mus. No. 7845. Polished ornament from Mirador. Grayish green, less granular, specific gravity 3.34.

Mus. No. 27874. Three beads. Mottled green and gray, coarsely granular, specific gravities 3.11, 2.94, 2.93.

Of these objects all but No. 11 appear to be jadeite. No nephrite could be identified among them. Nos. 1 and 2 were selected for further study, and gave the following analyses:

	1	2
Ignition	1.81	.53
Silica	58.88	58.18
Alumina	25.93	23.53
Chromic oxide	.12	....
Ferrous oxide	.24	1.67
Lime	.40	2.35
Magnesia	.36	1.72
Soda	11.64	11.81
Potassa	.63	.77
	100.01	100.56

If the water in No. 1 be regarded as replacing alkalies, the mineral approximates very nearly in composition to normal jadeite, $AlNa(SiO_3)_2$. Both analyses fit in well with Damour's series.

Under the microscope No. 1 resembles No 59927 from Costa Rica, to be described further on. It is a granular aggregate of colorless or greenish crystals at very imperfect outline, none pleochroic, but polarizing in very brilliant colors. It has, however, a much coarser texture than the Costa Rica specimen; the larger granules measuring at times 2 millimeters in diameter. These larger forms are all monoclinic with the optic axis in the plane of symmetry, and give extinction angles on sections parallel with the clinopinacoid varying from 35° to 40°. Promnent prismatic cleavages are developed, which in basal sections cross at nearly right angles. Many of the crystals also show twin lamellæ and carry numerous fluidal inclusions with rapidly moving bubbles.

The striking feature of the section is that the granules are all badly shattered and traversed by irregular fractures, which, with a power of seventy-five diameters, appear somewhat like the irregular canals of serpentinous matter so often seen in altered olivine. Under a power of one hundred and seventy diameters it becomes apparent that they are undergoing alteration into a fibrous nearly colorless product resembling the common change of augite into fibrous hornblende as seen in basic rocks. The alteration begins with a fraying out along the lines of cleavage and fracture, and has in a few instances gone on till but a rounded granule remains of the original mineral.

In many instances these veins of fibrous material carry plates of a clear, colorless, biaxial, eminently micaceous mineral, showing between crossed nicols the peculiar blistered appearance and brilliant iridescent polarization colors of muscovite. From their small size I am unable to say whether they are in all cases a product of alteration of the pyroxene or original inclosure. I am, however, inclined to the former hypothesis, since they occur only along lines where the alteration is greatest and have not been observed in the perfectly unaltered mineral. In some of the larger jadeite objects of the Museum collection from this same locality the micaceous mineral appears in flakes of such size as to be macroscopically recognizable in the form of minute silvery white inelastic scales. The chemical composition of the rock as a whole is such as to indicate that they are paragonite rather than muscovite. Where these veins are widest the interior is often occupied by a clear and perfectly colorless biaxial mineral without cleavage or crystalline outline, which polarizes in brownish or yellow colors, and which shows the same optical orientation over considerable areas, thus giving rise to what may be called a pseudo-ophitic structure, the grains of still unatered pyroxene representing the inclosures. Fig. 4 shows the structure of this rock as it appears under a power of twenty-five diameters.

The second jade, No. 115213, is, like the last, an aggregate of imperfectly outlined crystals. Under the microscope the texture is found to be very uneven; portions of the slide showing aggregates of extremely small and ill-defined particles which permit of no satisfactory measurements or determinations, sometimes slightly fibrous or scale-like, and sometimes granular, while other portions show distinct crystalline forms of all sizes up to 1 millimeter in diameter and which show the cleavage and optical properties of a monoclinic pyroxene. The clear, colorless, mica-like mineral also occurs here. The rock otherwise differs in no essential particular from a jadeite from China, samples of which we have here, received from Dr. A. D. Meyer (28820).

With Central American jade objects the Museum is well supplied. A few only are from Nicaragua and Guatemala; the finest are all Costa Rican. Here, too, jadeite is the dominating mineral species; although with the true jades are many articles of softer green stones, and occasionally an object of quartz or chalcedony. To Dr. Hallock's series of specific gravity determinations we may properly add a number of earlier values obtained several years ago by the late G. W. Hawes and by Mr. F. W. Taylor, and not hitherto published. The specimens examined are described below, following the order of their density:

No. 59934. Polished ornament, Sardinal, Costa Rica. Deep olive-green, not distinctly granular, specific gravity 3.344, Hallock.

No. 59908. Polished ornament, Sardinal. Pale green with whitish flecks, translucent, slightly granular, specific gravity 3.332, Hallock.

No. 28977. Elaborate carving, Nicoya, Costa Rica. Dark, rich green, translucent, granular, specific gravity 3.33, Hawes.

No. 31906. Polished tube, Guatemala. Light, grayish green, granular, specific gravity 3.33, Hawes.

No. 28990. Fragment, Sardinal. Light green, very granular, specific gravity 3.33, Hawes.

No. 59907. Ornament, Sardinal. Mineral like No. 28977, specific gravity 3.326, Hallock.

No. 59947. Ornament, Jesus Maria, Costa Rica. Blackish green, mottled, granular, specific gravity 3.32, Taylor.

No. 59927. Fragment, Sardinal. Pale green, translucent, specific gravity 3.32, Clarke.

No. 28992. Fragment, Culebra, Costa Rica. Mineral, like No. 28990, slightly darker, specific gravity 3.27, Clarke.

No. 28991. Hatchet, Liberia, Costa Rica. Grayish green, finely granular, specific gravity, 3.26, Hawes.

No. 10452. Large ornament, Ometepec Island, Lake Nicaragua. Varying shades of green and grayish green, very finely granular, specific gravity 3.26, Hawes.

No. 59968. Small ornament, Nicoya. Dark green, not distinctly granular, specific gravity 3.11, Taylor.

No. 59917. Small ornament, Sardinal. Bright green, granular, specific gravity 3.01, Taylor.

No. 59857. Small ornament, Las Huacas, Costa Rica. Green and gray blotches, coarsely granular, specific gravity 2.956, Hallock.

No. 28987. Ornament, Liberia. Greenish gray, granular, specific gravity 2.87, Hawes.

No. 60048. Fragment, Rio de Buena Vista, Costa Rica. Green, translucent, specific gravity 2.71, Clarke.

No. 59923. Ornament, Sardinal. Pale olive-green, compact, not granular, specific gravity 2.65, Taylor.

No. 59856. Ornament, Las Huacas. Bluish green, mottled, not granular, specific gravity 2.621, Hallock.

No. 59845. Ornament, Nicoya. Like 59857, but darker, specific gravity 2.62, Taylor.

No. 59932. Ornament, Sardinal. Grayish green, faintly translucent, not distinctly granular, specific gravity 2.62, Taylor.

No. 59937. Ornament, Panama, Costa Rica. Like 59932, specific gravity 2.62, Taylor.

No. 59955. Ornament, Boquerones, Costa Rica. Like 59932 and 59937, specific gravity 2.60, Taylor.

No. 328. Ornament, Ometepec Island, Lake Nicaragua. Brownish, highly polished, specific gravity 2.593, Hallock.

No. 59855. Ornament, Las Huacas. Like 59856, specific gravity 2.589, Hallock.

No. 59860. Ornament, Las Huacas. Dull bluish-green, opaque, specific gravity 2.377, Hallock.

No. 59858. Ornament, Las Huacas. Dull light-green, soft, specific gravity 2.324, Hallock.

No. 59912. Ornament, Sardinal. Like 59858, specific gravity 2.30, Taylor.

No. 59894. Ornament, Sardinal. Dull grayish green, soft, specific gravity, 2.294, Hallock.

No. 59868. Small ornament, Nicoya. Dark green, specific gravity 2.29, Taylor.

No. 59899. Ornament, Las Huacas. Dark green, not mottled, soft, specific gravity 2.282, Hallock.

No. 59924. Ornament, Sardinal, dull green, not mottled, soft, specific gravity 2.266, Hallock.

It will at once be seen that these objects, as regards density, fall into three pretty well defined groups. The highest values represent jadeite, more or less impure, and of various qualities; the middle group is near quartz in specific gravity, and some of its members certainly belong to that species; the lowest division contains ill-defined substances, which are also characterized by softness.

Four of the objects, viz, two jadeites, one quartz-like mineral, and one of the softer stones were selected for more complete investigation. The supposed quartz, No. 60048, from Rio de Buena Vista contained 97.10 per cent. of silica, 1.85 per cent of alumina and oxide of iron, no lime, and no magnesia. No further examination seemed to be necessary. The jadeites, Nos. 59927 and 28992, however, were more interesting. In composition they are as follows:

	59927, Sardinal.	28992, Culebra.
Ignition	.90	.93
Silica	59.18	58.33
Alumina	22.96	21.63
Ferric oxide	} 1.87	1.71
Ferrous oxide		.73
Lime	1.52	4.92
Magnesia	.67	3.09
Soda	12.71	8.13
Potassa	trace.	.22
	99.81	99.69

Traces of manganese were found in both samples.

Of these jades, the first was fine in color, texture, and translucency; the second was coarse, mottled, and opaque. The one approximates in composition to normal jadeite, the other varies from it both in composition and density.

Under the microscope the Sardinal specimen appears as a finely granular aggregate of colorless crystals, none of which possess perfect crystalline outlines, because of mutual interference. The texture is very uneven, scattering and clustered forms, from 0.1 to 0.5^{mm} in diameter, being distributed irregularly through a ground-mass composed of minute granules and scales which between crossed nicols blend into each other without distinct lines of separation. The mineral is almost perfectly colorless in the thin section or with a very faint greenish tinge and non-pleochroic, but polarizes in brilliant red, yellow, and purple colors. It is rendered slightly impure through inclosures of innumerable minute black and brownish dust-like particles the nature of which a power of seven hundred and fifty diameters fails satisfactorily to determine.

The larger forms show two well-developed cleavages which in basal sections cut each other at approximately right angles. An optic axis lying in the plane of symmetry appears in both basal and orthopinacoidal sections. The angle of extinction for section parallel to $\infty P \infty = 0^\circ$; and for those parallel to $\infty P \grave{\infty}$ varies from 35° 40°. These are properties common to the monoclinic pyroxenes, and would not in themselves alone indicate decisively any one particular variety.

Krenner,* who has studied jadeites of similar composition and structure from Burmah, claims as a result of his examinations and the analyses of Damour, that the mineral is a soda-spodumene.

The Culebra jadeite, 28992, differs structurally from the last (59927) in that it is made up largely of an aggregate of elongated and irregular scales and fibers compactly matted together, in which the individual scales blend into one another as the stage is revolved. It seems to correspond to the "*Stengel-faserig*" aggregate of the Germans. Throughout this scaly fibrous ground-mass are scattered occasionally larger and very irregular forms wholly without crystal outlines and rarely showing cleavage lines. All are colorless and non-pleochroic, and both large and small give extinction angles varying from 29° to 40°.

The descriptions given above agree closely with those of other observers. M. Cohen† describes a jadeite from Thibet as a granular aggregate of crystals of a mineral belonging to the pyroxene group and of *omphacite-like* habitus. The crystals show a nearly rectangular cleavage, give extinction angles of 41°, and show an optic axis in both orthodiagonal and basal sections. Fluidal inclusions were observed and occasional

* Neues Jahrb., etc., 1883, II, 1st H., p. 173.

† N. Jahr. f. Min., etc., 1884, 1 B., 1 Heft., p. 71.

grains of free quartz. Schoetensack* describes a "true jadeite" from Monghoung, in Burmah, as being a homogeneous aggregate of large granules and long curved lamellæ, with the cleavage of pyroxene (87°), and giving extinction angles of 35°.

The last of the four Costa Rican specimens examined was the soft dark green specimen from Las Huacas, No. 59899. In composition it is as follows:

Ignition	10.39
Silica	70.49
Alumina	11.39
Ferrous oxide	2.39
Manganous oxide	trace
Lime	3.83
Magnesia	.57
Alkalies	undetermined
	99.06

A microscopic examination shows that the mineral is evidently a highly altered volcanic tuff, but very difficult to make out. The mass of the rock is made up of a greenish-gray amorphous felt, through which are scattered rounded bunches of a bright green chlorite and small, colorless points and elongated crystals, which may be felspathic, although they are too small to show twin striæ. There are also occasional colorless, elongated, and curved shreds, which are wholly without action in polarized light and which are doubtless glass.

Two portions of a chambered shell of a minute rhizopod occur in the slide. Not even by courtesy can this substance be classified as jade.

Through the kindness of Mr. Thomas Wilson, whose collection furnished the Robenhausen nephrite already described, we have been enabled to examine several other worked specimens of minerals which are sometimes classed, though loosely, with jade. They come from various localities and may be briefly summarized as follows, in the order of their specific gravity as determined by Dr. Hallock:

No. 100365. Robenhausen, Lake Pfäffikon, Switzerland. Green, mottled saussurite, specific gravity 3.418.

No. 100586*a*. Same locality. Dark green saussurite, specific gravity 3.403.

No. 100031. From Brittany. Chloromelite? Dark green, mottled, specific gravity 3.392.

No. 100630. Yverdun, L. Neuchatel, Switzerland. Pale green adze, specific gravity 3.347.

No. 100238. Brittany. Fibrolite, specific gravity 3.147.

No. 100516. Estavayer, L. Neuchatel. Black, specific gravity 3.132.

No. 100629. Yverdun. Green nephrite, specific gravity 3.028.

No. 100586*b*. The Robenhausen nephrite already described, specific gravity 3.015.

No. 100670. L. Constance. Dark green nephrite, specific gravity 3.009.

No. 100029. Brittany. Black mineral, specific gravity 2.705.

Of these the fibrolite, 100238; the saussurite, 100586*a*; and the

* *Op. cit.*, p. 7.

black specimen, 100516, were examined further, and an analysis was also made of a fragment of massive saussurite from the Saas Valley, Switzerland, out of the Museum collection. The results of analysis were as follows:

	Fibrolite, 100238.	From Estavayer, 100516.	Saussurite, 100586*a*.	Saussurite, massive.
Ignition	1.31	.65	.30	.54
Silica	34.66	45.13	49.90	48.29
Alumina	63.24	16.55	29.76	27.65
Ferric oxide	trace	13.59	2.52	1.45
Ferrous oxide		4.20		
Manganous oxide		trace		
Lime	none	11.02	11.77	12.95
Magnesia	.37	5.48	5.80	5.36
Soda		3.89	3.21	3.57
Potassa		trace	trace	trace
	99.58	100.51	100.26	99.81

Chemically the second of these rocks is like a saussurite, saussurite itself being a very variable mixture, ranging from mainly a zoisite to mainly a feldspar. Microscopically, however, it is seen to be a mixture of various minerals, and is evidently a highly altered basic rock, possibly a diorite. If so, the original constituents are now so completely altered as to be scarcely recognizable. The most abundant constituent is a bright green or bluish amphibolic mineral, mixed with more or less chloritic matter and various decomposition products. Throughout this ground-mass are scattered abundant yellowish grains and granular aggregates of secondary epidote, a colorless mineral with the optical properties of zoisite, and rounded grains of an iron ore, each inclosed in a narrow, nearly colorless border of leucoxene (?). The felspars, if such existed, are no longer recognizable. Other minerals of a secondary nature are present, but need not be alluded to here.

As for the fibrolite, No. 100238, this is shown by the microscope to be made up of innumerable minute, greatly elongated, colorless needles arranged in bundles with their longer axes approximately parallel, often broken transversely, and crowded into a dense mass, and usually with a decided plumose structure. The needles are to minute for a determination of their optical properties. These needles make up the entire mass of the rock, except for a few minute rounded granules, which are quite opaque and resemble an iron ore.

The question has been asked if there are any means by which an object may be identified as nephrite or jadeite without resorting to the destructive process of cutting a thin section or making other tests such as will involve a more or less defacement of the object. In a general way it may be stated that the jadeites are of a distinctly granular, or at least scaly-fibrous texture, while the nephrites are uniformly fibrous and compact throughout. These distinctions can sometimes be detected by

the eye alone or with the pocket lens, as in the case of the jadeite beads from Mexico. Professor Arzruni,* however, has shown that nephrite is not in all cases an original mineral, but in some instances results from a molecular re-arrangement or uralitization of a mineral of the pyroxene group. He, therefore, very appropriately divides them into the primary nephrites and pyroxene nephrites. H. Traube† has shown, too, that a portion of the nephrite from Jordansmühl in Silesia is secondary; as is also that of Reichenstein, the latter resulting from the molecular alteration of diopside.‡

Beck and Muschketow§ too, it will be remembered, considered the asbestus fibers in the Bustraja nephrite as secondary, and noted the presence of still unaltered granules of diopside in the nephrite from Samarkand and Turkestan. It would therefore appear that the true nephrite may grade into a granular diopside rock resembling jadeite, and that therefore the purely macroscopic method suggested can not in all cases be relied upon implicitly. A safer, and indeed the only practical, means of distinguishing between the two substances under the circumstances noted above would seem to be by their specific gravities, the jadeites varying from 3.01 to 3.32, while the nephrites rarely reach a density of 3.00.

As regards the possibility of distinguishing by means of thin sections and the microscope between nephrites from various sources. A majority of the authorities consulted (and among them are those who have devoted much time to the subject and who having critically examined a large number of slides are capable of rendering opinions of value) appear to favor the view that this is practicable. As for ourselves, with our present experience, we confess to a feeling of skepticism. The presence or absence of inclosures of diopside, magnetite, or ferruginous oxides, the condition of these oxides, whether as ferric or ferrous, the varying tufted, bent, confused fibrous and even granular condition of the constituent parts, are all, together with the color variations and other structural peculiarities, matters of two slight import to be of weight from a petrographic stand-point. If, as seems possible, the majority of the nephrites are of secondary origin, why may we not expect to find all, or at least a great variety, of the structures described in the same or closely adjacent rock masses? Chemical analyses on samples from near-lying, or even the same, localities are found often to vary as greatly as those from localities widely separated. Why may we not expect the same structural variations when once they are carefully looked for? To our own minds sufficient assurances that the widely scattered jadeite and nephrite objects were derived from many independent sources and pos-

* Zeit. für Ethnologie, 1884, p. 300.

† Neues Jahrb. f. Minn., etc. Beilage Band III, 2. Heft, 1884, p. 417.

‡ Neues Jahrb. f. Minn., 1887, II B., 2 Heft, p. 275. The alteration is accompanied with a diminution in the amount of lime; the diopside yielding 21.41 per cent. and the tremolite (nephrite) 11.16 per cent.

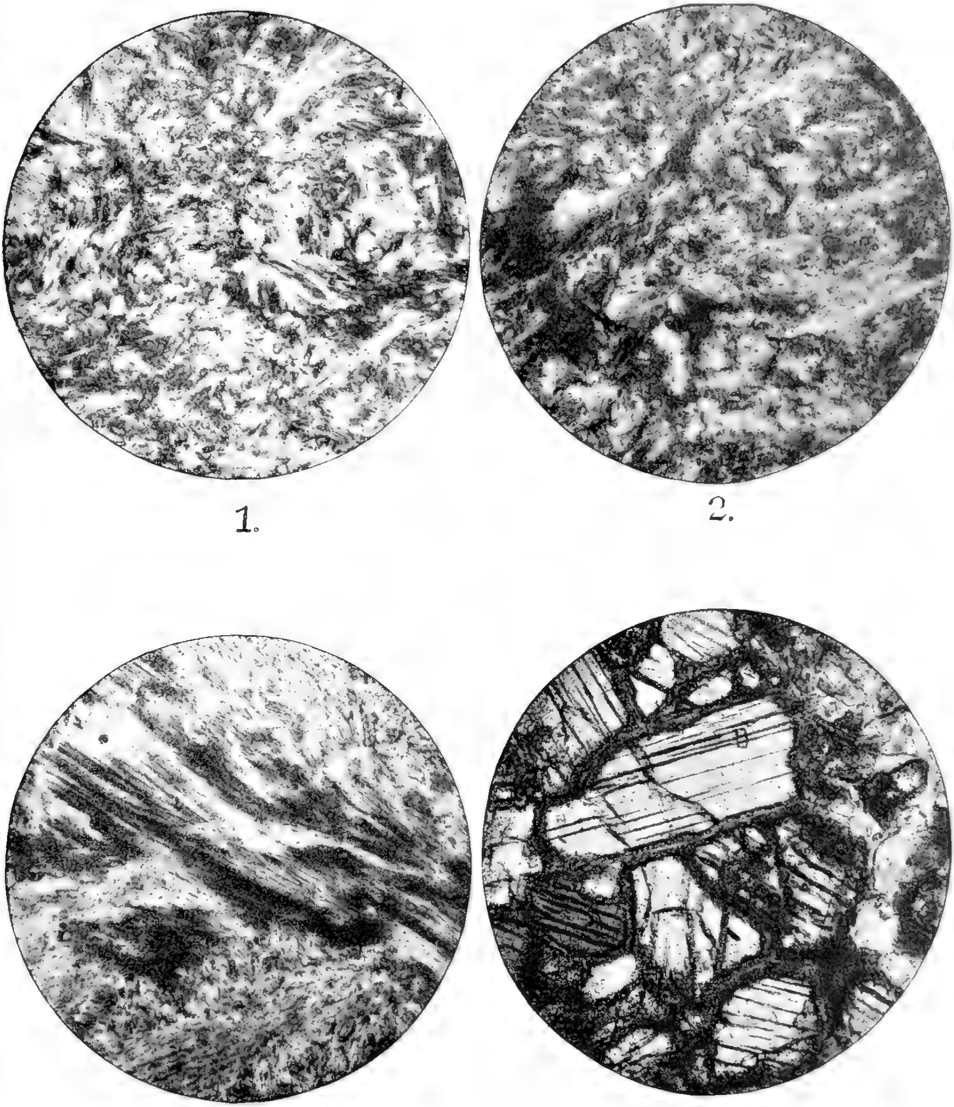
§ *Op. Cit.*

Jan. 5, 1889.

sess no value whatever in the work of tracing the migration and intercommunication of races lies in the fact that these substances are comparatively common constituents of metamorphic rocks and hence liable to be found anywhere where these rocks occur. Their presence is as meaningless as would be the finding of a piece of graphite. The natives required a hard, tough substance capable of receiving and retaining a sharp edge and polish, and took it wherever it was to be found.

EXPLANATION OF PLATE—MICROSTRUCTURE OF NEPHRITE AND JADEITE.

Fig. 1. Nephrite, New Zealand .... $\frac{25}{1}$
2. Nephrite, Alaska .... $\frac{25}{1}$
3. Nephrite, Liberia .... $\frac{25}{1}$
4. Jadeite, Oaxaca, Mexico .... $\frac{25}{1}$



MICROSTRUCTURE OF NEPHRITE AND JADEITE. (Page 115.)

FIG. 1. Nephrite, New Zealand. $\frac{25}{1}$.
FIG. 2. Nephrite, Alaska. $\frac{25}{1}$.
FIG. 3. Nephrite, Siberia. $\frac{25}{1}$.
FIG. 4. Jadeite, Oaxaca, Mexico. $\frac{25}{1}$.

THE NAVAJO SHOEMAKER.

BY ALEXANDER M. STEPHEN.

The Navajo art of shoemaking is a very simple one, and is practically confined to the men.

An awl and a knife are the only tools used. These they very usually combine in a two-bladed pocket-knife, the smaller blade being rubbed down to form the awl. Still the bone awl is very common; those made from the leg bone of the deer being preferred.

The stone knife, for practical purposes, is entirely unknown. It is now only used in religious ceremonies and for surgery. In cases where they deem the use of the lance necessary, under no condition will they use one of metal. It must always be of obsidian, although I have known them to use a fragment of dark-colored glass bottle.

They use three materials to make a shoe—buckskin for the uppers, raw-hide (preferably that of the ox) for the sole, and the loin sinews of the sheep, goat, or deer for sewing. The thick neck-skin of deer and badger are occasionally used for soles.

A piece of raw-hide of suitable size for the soles having been procured, it is first pounded with a lump of stone on a rock until it becomes somewhat flexible. The hair is scraped off, but not very close, and it is then buried in moist earth for three or four days to render it soft and pliable. It is then taken out, and the Navajo sets his foot upon it on the ground and cuts out the sole about half an inch or so larger than the size of the foot all around, and at the toe, at least an inch longer.

The soles are then held before the fire and thoroughly rubbed with fat on the hair side. He then fits the shoe sole to the exact size of the sole of his foot by turning up the edges all around close to the sides of the foot, the point being brought well up over the great toe. He next fits a piece of buckskin to form the front upper, inclosing the foot snugly but without compression. Tearing a few fibers of sinew and wetting them with his lips he rolls them on his knee to a stout thread, making two of these and tying them together. He now bores a hole through the sole at the toe and draws both these threads through it from the outside the knot preventing them from passing entirely through.

With one of these threads he first sews down the left side (of course he always begins with the left shoe), and with the other he sews the right side. These seams extend just the length of the front upper. The back upper is then fitted so as to wrap around the ankle and well down on the left or outside of the foot, where it is secured with two silver buttons.

Close to the sole, where the front and back uppers meet, they are fastened together at each side with a short thong of buckskin.

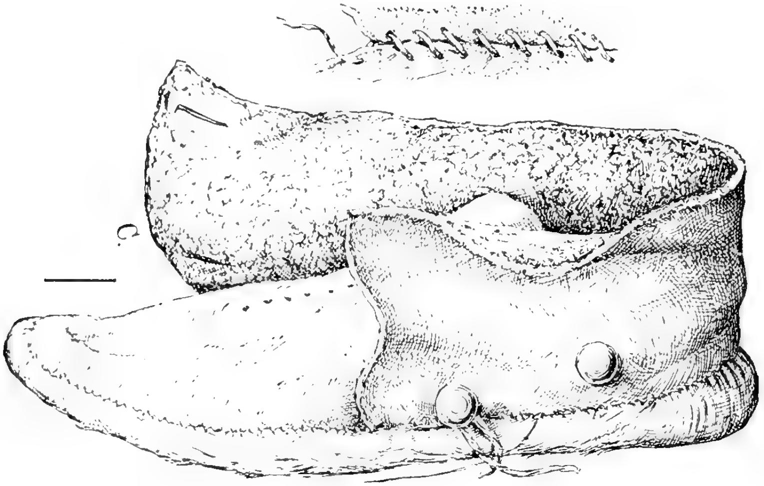


FIG. 1. Navajo shoe, finished.

The specimen* marked C (fig. 1) shows the finished shoe in the style most commonly used, because the method of sewing it is the easiest, being merely successive simple stitches. No significance attaches to the two parts of the uppers being of different colors. Some make them of buckskin all of one color. This style of shoe is called Ke-bĭ kĭt-is-tiz. The stitch with which it is sewed is in process the same as wrapping a thread around a stick, hence the term for wrapping "Kĭt-ĭs-tĭz" is applied to it.

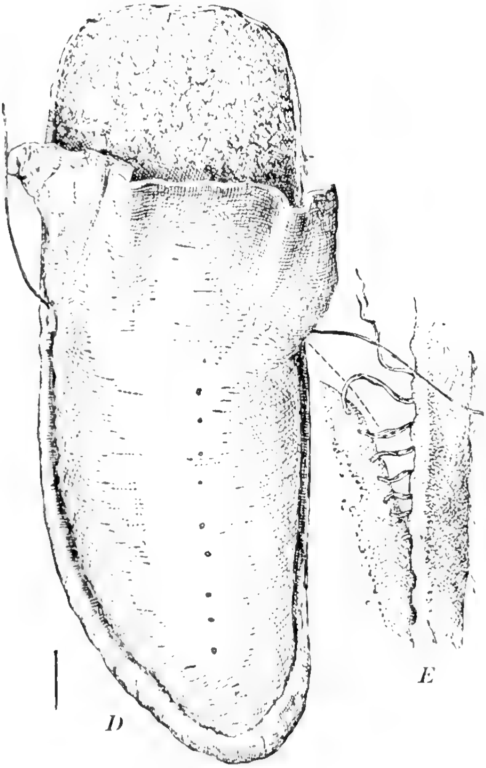


FIG. 2. Navajo shoe, unfinished.

The specimen marked D (fig. 2) is called Ke-bĭ tûta ĭt-si, a term implying that the sole incloses the upper portion. This, as the foregoing legend indicates, is the earliest form of skin shoe; this and the former style are the two most commonly used. The small specimen marked E shows another kind of stitch, and shoes sewed in this manner are called Ke bi-kagi ĭt-si, denoting that the upper barely covers the edge of the sole. This stitch is entirely longitudinal, and is taken in the sole midway along

* Refers to collection presented to the National Museum by Mr. Stephen.—ED.

the width of its edge. When finished carefully the serrated edges along the seam should be perfectly regular, and many of the young men take great pains with this style of seam.

The other specimen, B (fig. 3), completes the four styles of shoe stitch known among the Navajoes. Shoes sewed thus are called Ke pîķ ya-a-klo—that is, "shoe with thread showing above."

The women's shoes are sewed in either of the above styles, and the front portion of the upper is fitted the same as on a man's shoe, but the back portion of the upper is always a half of a buckskin, which is wrapped around the leg from ankle to just below the knee. A long strip of buckskin is also attached to this half skin, which strip constitutes the outer wrapping, laid in regular overlapping turns from the foot upward to just below the bottom of their short skirt, where it is secured with silver buttons.

In snowy weather they sometimes make from goat-skin a sort of overshoe, sewed with yucca—the skin being turned hair side in, and cut so that one straight seam from toe to ankle completes the shoe. It is called Ke tcûgi—worthless shoe. The early yucca shoes were called Tsä zî^{n} ke. Yucca is tsä zi^{n}—literally "bunch of awls," from the manner in which the yucca grows in bunches and its sharp pointed and awl-like tips. The early yucca and grass shoes are always described as sandals.

Formerly the Navajoes ornamented their shoes with beads and dyed porcupine quills, but these are now never used.

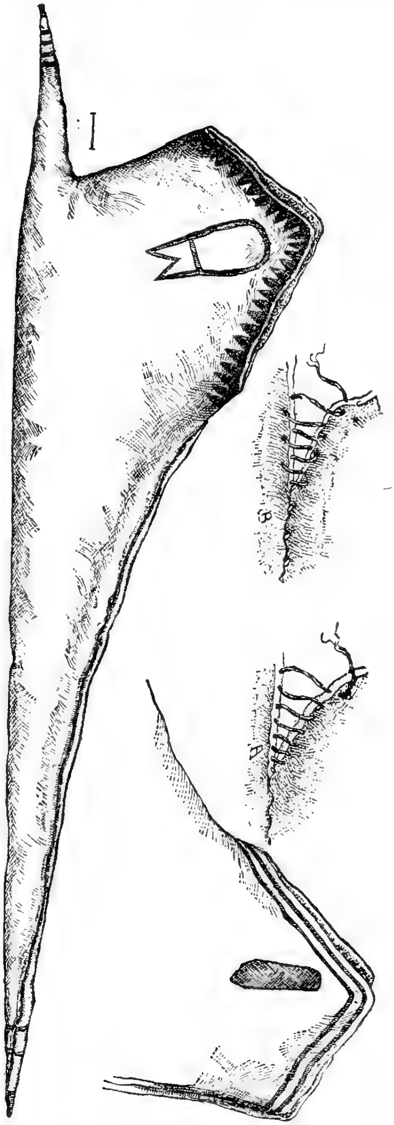


FIG. 3. Navajo dance shoe.

I procured a curious pair of shoes called Ke-nas-khûti Ho-zó-hi "shoe sewed with single straight seam that makes a peculiar mark." They are only used by the sacred dancers in the ceremony known as the "Song of the winds."

Formerly these dancers carried snakes of all sorts, as the Mokis do, in their snake dance. Now, however, the Navajo only paints a snake upon his arms, the tail on his shoulder, the body twining down the arm over the back of the hand and between the fingers, the head depicted on the palm.

The shoes worn in this dance are stuffed with grass and tied on the feet, the dancers, as they swing their legs, make marks on the sand like the trail of a snake. The refrain at the end of each line of their song is this phrase—Ho-zó-hi—which is sung as the marks are made with the toe or heel.

The shoes are each marked with a foot-print designating the right and left. The other curious figure represents a double-lobed pouch formerly worn by the "song-men." These dance shoes derive their peculiar form, I have been told, from those worn in early days at this snake or wind dance.

These were of an entire bunch of yucca for each foot, the stems bound together at the sharp lips and braided in the center with cross strands, which is very probable. But it seemed very interesting that we should find among the Navajoes what I fancy must be nearly a counterpart of the fashionable shoe worn in the days of Edward IV. Fig. 4, called Tsa-kia (white awl), is used by the women in basket-making. A similar one, called Tzin-tsä (bone awl), is used in sewing skin bottles and coarse stitches of any skin work. The iron awl, pec-tsä, (Fig. 5) is a very rough specimen of their metal awls for they have many made with great nicety from long knife blades rubbed down till they are slender, and as sharp as cambric needles. The awl I send is the one all the specimens are sewed with.

FIGS. 4–7. Awls and needles.

I also inclose two needles, the iron one (fig. 6) "pec be nakan," the wooden one "tsĭn be nakan" (fig. 7) made from a twig of rose-bush or rather a shrub belonging to the rose family. They are used in sewing the selvage and corner tassels on saddle blankets, etc.

MYTHS (NAVAJO SHOE).

According to my apprehension of Navajo geogony this earth is not a solid, but a cubical shell, inclosing four other, and perhaps many more, successive shells, but the history of only four of these within the outer shell on which we now live are commonly known. The persons who existed on one of these spheres in earlier times, were all genii or deities. Animals had, however, been created. They were made from clay by Pe-go tcĭti. Also, a family of four brothers were

in existence, their names: Sleep, Hunger, Misery, and Louse. Their father was slain.

The deities came together and built the first hut; it was made in the form of a cone. Their form is still preserved in the construction of the Navajo "ho-hran."

Spanning from east to west, the sides were of sun rays. The north and south sides were of rays from the rainbow. There were assembled at the making of the house—

First man and first woman—man and wife, Hos-di-yélti: "He who never speaks," he is also called Hai-yolç-kalç, "The god of the early day-light." Tjalç kélç, "Darkness," a female deity. These two are also husband and wife.

I-yá-dĭlç-kĭlç, "The black (cloud) above." A male deity.

Na-asân, the first-earth, a female deity, these two are also husband and wife.

Tjon-a ái, "The sun god," and his wife called Asûn nût le-hi, a female, and the most highly esteemed of all their deities. At night-fall she has grown to be a wrinkled, exhausted old woman, but she renews her beauty and virginity on the dawn of every morning.

Klé on-a-ái, the moon god, and his wife, Yo la-kai asûn, White Shell Woman. There were also present the seven wind gods, each of different color, four of them beneficent and three of them malignant and destructive.

Hos-dj-yelti brought with him the nine different kinds of corn known to the Navajo. White, yellow, blue, speckled, etc.

These were laid in this hut and from them were formed four pairs of people, male and female, and one old woman. The gods supplied these corn people with everything necessary, except shoes, and these the people made for themselves from three kinds of grass, three kinds of yucca, and the bark of the juniper.

The people continued to make and wear these shoes for a very long while. One day when a great many of the corn men were sitting in a hut making shoes and sleeping-mats and door curtains from grass and yucca, Hos-dj-yelti, wearing a mask, appeared among them. As I have said, he never speaks, but conveys his meaning by signs. He stooped and drew with his finger the figure of a foot-print on the sand—the left foot—beginning at the toe and drawing the left side, then from the toe drawing the right side.

The sole they were to make from the neck skin of the badger, the uppers from deer-skin, and the shoe was to be sewed with sinew from the back of the mountain sheep. The name of the corn man who owned this hut was E-dil-kij i, the cutter, and he proceeded to make the first shoe, and as he finished it all the men pronounced it beautiful.

Coyote came in to admire the new foot-gear, and after he went out the shoe was missed and every one knew that Coyote had stolen it. E-dĭl-kĭj i cursed Coyote and all his family, and then went on making

a shoe for the right foot. Presently Coyote returned and asked the people why they had been cursing him. "Because you stole my beautiful shoe," said the cutter. "Listen to me, brother," says Coyote: "I carried the shoe away to do you a good turn. Don't you know, if you go on making shoes like it you will lose your eyes and die?" Coyote then goes on to give lengthy reasons for this, the drift of which was this way:

Hos-dj-yeltis face is of the color of the first light of the east—"la-pa" or pale gray. The freshly cut edge of the badger skin is of this color, and must be concealed, because Hos-dj-yelti always conceals his face with a mask when he visits mankind.

The cutter listened to all this but did not believe it, so he went on making his shoe and had about half finished it when he was struck blind, as were all the people who were in the hut observing. "Aha," said Coyote, "perhaps you believe me now!" and ran off, jeering at them.

The people were in great distress, for they then knew neither "song prayers" nor "medicines," and were therefore helpless.

By-and-bye Hos-dj-yelti, with other deities, came to them, and the ceremonies of the Hos-dj-yelti dance were performed and taught, and the people all recovered.

They were then told that whenever they made this kind of shoe, they should always cover the edge of the sole with paint, either red, yellow, blue, or black. They were also told that thereafter whenever any one had sore eyes they should perform the ceremonies then shown them and they would recover. This elaborate dance is still frequently observed for this purpose.

In these early days the women were once gathered in a hut making baskets from peeled withes. A basket was finished, and as it was of this sacred color "la-pa," the maker and all the women who looked at it became blind. The same incidents as at the making of the first shoe transpired, and after the women had recovered their sight Hos-dj-yelti painted colored figures upon the basket, and since then, when that kind of basket is made, it must always display some colored decoration.

There are different versions of the foregoing myth, as indeed there are of all the Navajo myths, but an old shaman once said to me, referring to these differences, "There are as many traditions and 'song prayers' as there are rays of the sun; they cover the earth as do the rays of the sun and the rainbow from opposite points. Some say your song is not right but they should rather say, 'your song differs from mine.' I say all are good; let each one follow the path he knows. All lead in the right direction if they are straight, that is, if the truth be told."

DESCRIPTION OF EIGHTEEN NEW SPECIES OF FISHES FROM THE GULF OF CALIFORNIA.

BY OLIVER P. JENKINS AND BARTON W. EVERMANN,

In July, 1887, the writers spent some time at Guaymas, on the east coast of the Gulf of California, making collections of fishes and other objects of natural history, in the interests of the institutions with which they are respectively connected (De Pauw University and the Indiana State Normal School) and of the Indiana University.

Among the fishes collected at this time eighteen species appear to be new to science. The types of all these are now in the United States National Museum.

A detailed account of the general collection is now in preparation and will soon be ready for publication.

We desire in this connection to express our indebtedness to Dr. David Starr Jordan for the use of his library and collections.

1. **Siphostoma arctum**, sp. nov. (Type, No. 39639, U. S. N. M.)

Head 11 in body to base of caudal; depth 20; dorsal 20, on about 0+5 rings; rings 15+39.

The top of the head scarcely carinated, the opercle without a prominent ridge. Snout 2.35 in head, keeled in the median line. Dorsal slightly higher than the width of a body ring, its length about equaling the head. Pectoral 3 in head. Distance from tip of snout to vent equals one-half the length of the tail. Caudal is about 3 in head.

Color in alcohol pale, with no evident markings except on the under side of the tube of the snout, and as far back as the posterior margin of the eye, where there are dark mottlings.

One specimen was obtained from the bay at Guaymas, 9^{cm} in length.

2. **Atherina sardina**, sp. nov. *Peje Reje* of the local fishermen. (Type, No. 39633, U. S. N. M.)

Head $4\frac{1}{2}$ in length to base of caudal (5 in total); depth 6 ($6\frac{3}{4}$); eye $3\frac{1}{2}$; D. IV, I—9; A. 25; Lat. l. 6—45—5.

Body rather slender, elongate, greatly compressed ventrally. Head short, greatly flattened above; snout a little greater than eye, blunt, with two evident folds or grooves across it; maxillary protractile, very broad, not reaching orbit; cleft of mouth oblique, curved, the lower jaw but slightly included. Eye moderate, $3\frac{1}{2}$ in head, $1\frac{1}{4}$ in interorbital space. Teeth in each jaw very small and wide-set, none on vomer or palatines; gill-rakers long and slender. First dorsal short and low, its origin a trifle nearer tip of caudal fin than end of snout, entirely in front of origin of anal. Space between first and second dorsals equals the length of both snout and eye. Distance from beginning of second

dorsal to base of caudal fin equals that from end of snout to insertion of pectorals, the fin lying over middle of anal; the first rays are highest, their length being a little greater than the diameter of orbit.

Origin of anal under anterior part of the interdorsal space, one and one half times as far from snout as from base of caudal; length of its base about twice that of the second dorsal, and about equal to head; the first rays the longest. Pectorals short, about two-thirds length of head. Ventrals small, short, inserted much in front of first dorsal and a little nearer snout than base of caudal, their tips not nearly reaching anal.

Scales large, cycloid, not very firm.

General color pale, each side with a broad lateral plumbeous band, two scales in width, and equaling one-fifth length of head; the upper third of this band is much the darker; above the band the scales are sparcely covered with fine dark punctulations; none below the band, and but few upon it. Top of head very pale, almost transparent on the interorbital area, but in front and behind thickly set with small dark spots; snout also marked with spots, lower jaw with some spots in front, plain behind; opercles plain; fins all more or less plainly marked with numerous small dark spots.

This species is known to us from three specimens (No. ——, U. S. National Museum), 3.50, 3.49, and 3.37 inches long, respectively, taken from the bay near the city of Guaymas.

This species seems most closely related to *A. eriarcha* Jordan and Gilbert, from which it differs, notably, in the more slender body and in the position of the fins.

3. **Atherinops regis**, sp. nov. Pez del Rey. (Type, No. 39632, U. S. N. M.)

Head 4.5 in body to base of caudal, the depth of head 8, its width 8; depth of body 4.5, width 7; dorsal VII, 11; anal I—22; scales, in longitudinal series, 46, in oblique, 15.

Color, in alcohol, pale, darker above the lateral band, the scales in this region having fine punctulations, a silvery lateral band slightly more than one scale wide, 0.6 the diameter of the eye, the upper third bordered by a dark line.

Maxillary not reaching the pupil, the lower jaw shorter than upper. Teeth in a single series, close set, incisor-like, weak, each with a short lateral branch on the main stem, not **Y**-shaped; tips brown.

Gill-rakers about 19 on lower limb of anterior arch, about 30 on lower limbs of succeeding arches, not strong, equaling diameter of pupil.

Eye large, equaling snout, 3.7 in head.

Origin of spinous dorsal in front of vent, its distance from tip of snout being but little more than half the length of the body, the origin of the first to the origin of the second dorsal contained 5.25 times in the length of the body. The origin of first dorsal is much nearer to the angle of the opercle than to the base of the caudal. The pecto-

rals are longer than head by one-fourth the length of the head, reaching to the middle of ventrals. Ventrals about reaching vent, 1.9 in head; scales firm, large; pores developed on scales on various parts of the body; 4 rows on the cheeks. Peritoneum black.

This species is allied to *A. affinis* Ayers, from which it differs in the longer pectorals, larger scales, and in the position of the spinous dorsal, which in this species is much nearer the head.

This species is common in the bay at Guaymas, where many specimens were obtained.

Measurements.

	Millimeters.	In body.	In head.
Body:			
Length to base of caudal	168		
Depth	37	4.5	
Width		7.	
Head:			
Length	37	4.5	
Depth		8.	
Width		8.	
Eye	10		3.7
Interorbital space	15		2.5
Snout	10		3.7
Width of mouth	12		3.
Lateral band	6		6.3
Tip of snout to origin of first dorsal	88		
First dorsal to base caudal	82		
Origin first dorsal to second dorsal	32	5.25	
Pectoral fin	45		
Ventral fin	20		
Longest ray of caudal	32		

4. Centropomus grandoculatus, sp. nov. (Type, No. 39630, U. S. N. M.)

Head in length of body to base of caudal, 2.7; depth of head, 5; width, 9; depth of body in length, 3.4; width of body, 9; dorsal, VII, I—10; anal III—7; scales, 8—52—10; scales in front of the dorsal, 21.

Allied to *C. pedimacula* Poey; the body elongate; the back somewhat elevated; profile concave; nuchal region convex, maxillary reaching a vertical line through the pupil; 3 in head. The snout is 3.7 in the head; eye large, and is 5 in the head; preorbital with small serræ on the posterior portion, directed backwards; preopercle with nearly equal, distinct teeth on the vertical limb; a series of graduated teeth on the horizontal limb; a strong spine at the angle, and a strong spine next above the angle, sometimes bifid; two flat spines at the angle of the anterior ridge; suprascapula with four strong spines; opercular flap about reaching the vertical from the front of the dorsal.

Gill-rakers 6+16 on anterior arch, in length equaling the diameter of the pupil.

Dorsal spines strong, the third being the highest and strongest; 1.8 in the head; the fourth but little shorter, but more slender, their tips, when depressed, scarcely reaching the tips of the ventrals. The insertion of the first dorsal spine is midway between tip of snout and last ray of second dorsal. The fourth dorsal spine is 2 in head.

Second anal spine very strong; straight in one specimen, slightly curved in another; 1.66 in head. Third anal spine a little longer, but much more slender than the second anal and longer than the third dorsal.

Caudal well forked.

Pectoral small; 2.2 in head; much smaller than the ventrals.

Ventrals with a strong spine; the spine nearly as long as the pectoral fin; soft rays of ventral as long as third dorsal spine.

Scales large on the sides; crowded in front of the dorsal; scaly sheath of anal extends farther than in *C. pedimacula*.

Color in alcohol, white below; dusky above the lateral line, which is black and conspicuous; scales on back and sides covered with numerous punctulations; first dorsal somewhat dusky, second lighter, coloration of both due to fine punctulations; a large black blotch on the tips of the ventrals and anal; the membrane between the second and third anal spines black.

This species differs from *C. pedimacula* Poey in the larger scales, in the more robust and more elevated body, and in the larger eye.

Two specimens were obtained from the bay at Guaymas.

Measurements.

	Millimeters.	In body.	In head.
Body:			
Length to base of caudal	230		
Depth	67	3.4	
Width	25	9.2	
Head:			
Length	85	2.7	
Depth		5.	
Width		9.	
Interorbital space	12		7.
Depth of caudal peduncle	27	8.5	
Third dorsal spine the longest	48		1.8
Fourth dorsal spine	41		2.
First anal spine	10		8.5
Second anal spine	51		1.66
Third anal spine	52		
Ventral spine	36		
Soft rays of ventral	47		
Pectoral fin	38		
Snout	23		3.7
Eye	17		.5

5. **Epinephelus Jordani** sp. nov. (Type, No. 39628, U. S. N. M.)

Head 2.6 in body to base of caudal (3.1 in total); depth 3.6 in body; depth of caudal peduncle 8.8; dorsal XI—17; anal III—11; scales very small, crowded, but not less than 160 in the lateral line, 20 above, not less than 40 below; length of largest specimen, 36^{cm}.

Body comparatively elongate, compressed. Head long, lower jaw protruding, maxillary extending but slightly beyond the eye in the smaller specimens and not at all in the larger ones. The eye is 7.2 in head, the interorbital space 6 in head. Preopercle slightly emarginate

above the angle and on lower limb below the angle; the serræ above the angle are very fine; at the angle stronger, the lower limb entire.

Nostrils not very near together. Distance between them 8 in longer diameter of eye. The anterior with a flap, circular. Posterior elliptical and not more than twice the diameter of the anterior.

Gill-rakers of anterior arch rather short, the longest about 2 in eye. Breadth of base about 2.5 in length. About 9 developed and 2 rudimentary ones on lower branch, one in the angle, 2 well developed on upper branch, with a few others rudimentary; on succeeding arches, all very short, being but knobs, or hardly developed.

Teeth on lower jaw in about two series, strong. On upper jaw several strong ones intermingled with many small ones. Two prominent canines in each jaw.

Caudal fin very slightly lunate. The outer rays scarcely longer than inner, 2 in head; pectorals reaching beyond the tip of ventrals, being 5 in the body and 1.9 in the head; ventral fin shorter than the pectoral, 6.25 in the body, its spine 4 in head.

The first three spines of the dorsal are graduated. The first 8.8, the second 4.26, the third 3.3, in head. The tenth spine is 4, and the eleventh is 3.8, in head. The longest soft ray, the sixth, is 2.3 in head. The origin of the dorsal is a little less than the length of the head from the tip of the snout.

The anal spines are graduated, the first 14.4, the second 6.4, the third 5.2 in the head. The fin is evenly rounded, the longest soft ray is 2.3, and the last 4.8 in the head.

Color in alcohol, much as in *E. bonaci* Poey, brown with irregular darker mottlings of considerable size, but varying much; belly paler; dorsal and anal fins of the general color of the body, the anal having the lower edge pale, the outer margin not evidently darker; ventrals black with the tip white; pectorals paler.

This species is nearly allied to *E. microlepis* Goode & Bean, from which it differs in the shorter maxillary, in the form of the caudal, which in this species is less lunate, in the smaller eye, in the wider interorbital space, and in the smaller number of gill-rakers.

It is also allied to *E. bonaci* Poey, from which it differs in the shorter maxillary, in the less robust body, smaller eye, wider interorbital space, and in the smaller number of gill-rakers.

We follow Dr. Jordan's manuscript in using the name *Epinephelus*, instead of *Mycteroperca* or *Tristropis*. The original type of *Epinephelus* was *E. ruber* Bloch, which is probably identical with *Mycteroperca acutirostris*.

This species is dedicated to Dr. David S. Jordan. This fish is rather common in the bay at Guaymas, where we obtained several specimens, and at which place it is in great favor as a food-fish.

Measurements.

	Millimeters.	In body.	In head.
Length of body to base of caudal	300	....	....
Head	115	2.6	....
Depth	84	3.6	....
Depth of caudal peduncle	34	8.8	....
Snout	30	....	3.8
From tip of snout to first dorsal	111	....	....
Maxillary	45	....	....
Eye	16	....	7.2
Interorbital space	19	....	6.0
Dorsal fin:			
First spine	13	....	8.8
Second spine	27	....	4.26
Third spine	35	....	3.3
Tenth spine	28	....	4.0
Eleventh spine	30	....	3.8
Sixth soft ray	50	....	2.3
Anal fin:			
First spine	8	....	14.4
Second spine	18	....	6.4
Third spine	22	....	5.2
Longest soft ray (fifth)	50	....	2.3
Last soft ray	24	....	4.8
Pectoral fin	60	5.0	1.9
Ventral spine	29	....	4.0
Ventral fin	48	6.25	....

6. **Kyphosus elegans** * (Peters.) (No. 39635, U. S. N. M.)

Head 3.5 in length of body to base of the caudal; depth 2 in length of body; dorsal fin, XI—14; anal, III—13; scales, 12–70–22.

Body elliptical, compressed, head short, snout very blunt, eye moderate, 3.5 in head, mouth small, nearly horizontal, the maxillary barely reaching the front margin of the eye, both jaws with a single close-set row of incisors, obtusely lanceolate, transparent on the extremities, most of the teeth with a dark spot in the middle of the body of each, teeth with conspicuous roots posteriorly, behind which there is no band of teeth; fine teeth on the vomer, palatines, and tongue.

Gill-rakers on anterior arch not long, the longest about one-half the diameter of the eye, slender, about 14 developed on the lower limb, those on the succeeding arches short, not well developed. Preopercle obsoletely serrate at and near the angle in the older specimens, not evidently serrate in the younger specimens; remaining parts of the limb entire. Preorbital covering but little of the maxillary. Squamation complete, all parts of the body and head being scaled, except a small space just above the snout, the preorbital region, the premaxillary, and tip of lower jaw. The scales on the head come far down, well in front of the anterior margin of the eyes, the maxillary well scaled; scales small, ctenoid, somewhat crowded anteriorly, about 70 in the longi-

* We have substituted the name *elegans* for the new name, *chopa*, proposed by us, as it is highly probable that our species is identical with *Pimelepterus elegans* Peters (Berliner Monatsberichte, 1869), from Mazatlan. We are indebted to Dr. F. Hilgendorf for the following notes on Peters' types, received while this paper is in type: "Schuppen über L. l. zähle ich 64–66 und ausserdem etwa 10 kleinere auf den Schwanzflosse. * * * Die Höhe des ersten weichen Strahles der Analis beträgt 38^{mm}. Die Basis-Länge der ganzen Flosse ist 68^{mm}." The original description applies equally well to *K. analogus* and to our species.

tudinal series besides 10 or 15 smaller ones. Soft parts of the vertical fins densely scaled, the other fins covered more or less with fine scales. Lateral line about evenly curved, with small wavy irregularities, more evident in some specimens than in others, extending as far as a line vertical from the posterior end of the dorsal, from which point it is straight and extends by a few pores on the caudal.

Dorsal fin low, the spinous part depressible into a groove, eleven spines, the sixth spine 2.4 in head, 4 in depth of body, continuous with the soft dorsal, the last spines lower, thus making a slight depression between spinous and soft parts. The base of the spinous portion equals the base of the soft portion. The anal fin with three spines, graduated, the third 0.66 of the diameter of the eye, soft part similar to soft dorsal but the anterior part is higher and the base shorter than the soft dorsal. Longest anal ray $2\frac{1}{2}$ in head, $2\frac{1}{4}$ in base of fin.

The caudal fin is forked, the upper fork slightly the longer, 1.17 in the head. Pectoral fin 1.6 in the head. Ventral fin 1.9 in head. the origin behind that of the pectoral. Peritoneum black.

Coloration, in life: Top of head and back dark bluish, sides lighter blue with metallic reflections, paler below the line with about 12 narrow, darker, horizontal bands running along the junction of the edges of the longitudinal series of scales, rather distinct in the middle region of the sides, less so forward and below; belly and chin white, cheeks silvery, a white line extends from the snout horizontally under the eye and as far as its posterior margin. A dark line under this line, as long as the maxillary, extends back from the maxillary. Dorsal fin blue, anal blue with pale base, caudal dusky, pectoral pale, tips of pectoral and base on inner side dusky, white below, axilla silvery.

This species is allied to *Kyphosus* (*Pimelepterus*) *analogus* Gill, differing in the higher anal and in the larger scales. (Scales 85 in *K. analogus* and the longest ray of anal, 4 in base of fin and 4 in head.) In the latter the body is deeper, and the eye rather smaller. It is rather common in the bay at Guaymas, where we obtained six specimens.

Measurements.

	Millimeters.	In body.	In head.
Length of body to base of caudal	134		
Depth of body	65	2.0	
Depth of caudal peduncle	14	9.5	
Length of head	38	3.6	
Snout	12		3.1
Interorbital space	15		2.5
Eye	11		3.5
Maxillary to tip of snout	10		3.8
Sixth dorsal spine	16		2.4
Base of spinous dorsal	35		
Base of soft dorsal	35		
Height of soft dorsal	11		
Second anal spine	8		4.8
Base of soft anal	30		
Height of anterior rays of soft anal	15		2.5
Height of posterior rays	10		3.8
Pectoral	23		1.6
Ventral fin	20		1.9
Longest ray of caudal	35		1.1

HERMOSILLA, gen. nov. (Family *Sparidæ*.)

General characters the same as those of *Kyphosus* Lacépède = *Pimelepterus* Lacépède, from which it differs: In the weaker gill-rakers; in having the margin of the preopercle entire; in having no teeth on the vomer or tongue, and no band of villiform teeth behind the incisors; in the squamation, the scales on the body being larger, 55 in the longitudinal series in *H. azurea;* the head not being so completely scaled, the top of the head, snout, preorbitals, space below the eye, the chin, and the preopercles being naked. It also differs in the relative sizes and forms of the vertical fins—the spinous dorsal is much longer than the soft dorsal, and the soft anal is higher and shorter than the soft dorsal.

(*Hermosillo*, capital of Sonora, the name derived from a word meaning beautiful.)

7. **Hermosilla azurea**, gen. et sp. nov. (Type, No. 39629, U. S. N. M.)

Head 3.56 in length of body to base of caudal; depth of body 2 in length; dorsal fin, XI—11; anal fin, III—10; scales, 11-55-17.

Body ovate, compressed, head short, snout 3 in head, blunt, maxillary about the diameter of the eye, barely reaching front margin of eye. Both jaws with a single series of close-set, equal, narrow, rounded incisors; no teeth on the vomer.

Gill-rakers slender on anterior arch about the diameter of the eye, 3+12; on succeeding arches much shorter. Preopercle entire. Preorbital two-thirds the diameter of the eye, nearly covering the maxillary.

Top of head as far back as the posterior margin of the eyes, the snout, the preorbitals, a narrow space below the eye, the chin, and the preopercles naked. The top of the head covered with pores; the preopercles covered with a net-work of grooves. The remaining parts of the head and body scaled. Five rows of scales on the cheeks below the eye, about 6 rows on the opercle, subopercle with 1 row.

The fins, with the exception of the spinous dorsal, covered more or less with fine scales. Scales moderate, ctenoid, 55 in the longitudinal series, not crowded anteriorly. Lateral line complete, traceable but a short distance on the caudal. Dorsal fin of eleven spines, the seventh, which is the longest, 1.8 in head; the alternate ones very strong, the spinous part continuous with the soft portion, the last spine not much lower than the soft dorsal, thus leaving but a slight depression between the two. The spinous part depressible into a groove, base of spinous part about one-half longer than the base of the soft portion. Soft anal shorter and higher than soft dorsal; anal with three spines, short but strong, the second the longest, 1.3 times the diameter of the eye; caudal forked, upper fork the longer; pectoral 1.5 in head, not quite equaling the ventrals which begin behind them.

Depth of caudal peduncle 7 in the body. Eye moderate, 3.7 in head; interorbital space 2.7 in head. Peritoneum black.

Coloration: Back and sides dark steel blue, lighter towards the belly; chin, throat, and belly white, the body with about twelve nearly vertical blackish cross bands, about as wide as the eye. The bands reaching the belly, sides of the face, under and in front of the eye silvery, but interrupted by a dark streak running from the maxillary to the angle of the opercle. An inky blotch on the margin of the opercle above the angle. Axilla black, the black extending somewhat below the base of the pectoral. Dorsal and anal dusky. Upper side of ventral dusky, lower side pale, but dusky on the webs towards the tips.

A very beautiful fish, apparently not common at Guaymas; two specimens were obtained, respectively 195 and 213^{mm} in length.

8. Pseudojulis venustus, sp. nov. (Type, No. 39631, U. S. N. M.)

Head with flap 3.3 in length of body to base of caudal, without flap, 4; depth of head, 5.3; width, 9 in length of body; depth of body, 3.6; width, 10 in the length; dorsal fin, IX — 12; anal fin, III—12; scales, 3–26–8; scales before the dorsal about 11. Body elongate, compressed, back more elevated in the older males; scales large, smaller on the breast; head, cheeks, opercle, and preopercle naked, preopercle entire. Teeth large, the four front ones in each jaw stronger. The posterior canines in four specimens present the following characteristics: In No. 1, small one present on the right side, absent on the left; in No. 2, barely evident on the right side, absent on the left; in No. 3, absent on the right, barely evident on the left; in No. 4, not evidently present on either side. Dorsal spines pungent, anal spines graduated, the first very weak, almost rudimentary. Gill-rakers on lower limb of the anterior arch about 9, slender, less than 0.5 the diameter of the pupil, on succeeding arches still shorter, almost rudimentary on the fourth arch. Gill membranes joined to the isthmus. Color in life: Dorsal and anal fins rose-red, with white edges; caudal orange; general color of the body olivaceous; a row of black spots on the back at the base of the dorsal, other spots along the lateral line. In the larger specimens, the males, there is a dark blue cross bar as wide as the eye on the body, at a distance of twice the diameter of the eye behind the pectoral, extending from the belly nearly to the lateral line. Teeth not evidently in two series. The front teeth canine-like. Snout 2.75 in length of the head without flap. Eye small, 5.75 in length of head without flap.

Pectorals 6 in the body length, extending to the tip of the ventrals. The ventrals are 7.5 in the length of the body, their origin being on a vertical passing through the posterior edge of the axilla. The lateral line drops abruptly a distance of three scales at a point two scales in front of the last dorsal ray.

This species is intermediate between *Platyglossus semicinctus* (Ayres) and *P. californicus* Günther (=*P. modestus* Grd.), the color much like the former, the form intermediated.

A very beautifully colored and graceful fish, not common at Guaymas, at which place we obtained four specimens.

Jan. 5, 1889.

9. **Gobius chiquita**, sp. nov. (Type, No. 39634, U. S. N. M.)

Head $3\frac{1}{2}$ in length to base of caudal (4 in total); depth, 5 ($5\frac{3}{4}$); eye, 4; scales 37 in longitudinal, 17 in transverse series; D. VI—9; A. 10.

Body rather stout, compressed; head short, somewhat depressed, widened behind orbits; snout short and narrowly rounded; profile in front of eye very steep, less so to occiput, and nearly straight from there to caudal fin; eyes moderate, well up, interorbital space very narrow, less than eye; greatest width of head equals greatest depth of body. Top of head, opercles, and space in front of dorsal naked, rest of body covered with small, evidently ctenoid scales, which increase in size upon the caudal peduncle. Dorsal fins two, the anterior of six flexible spines, their length about equal to the depth of the body; the distance from the snout to the origin of the spinous dorsal is a little more than one-third the distance to base of caudal; the second dorsal of nine soft rays is but slightly separated from the spinous part, its origin being about midway of the total length of the fish, its rays are not quite so high as are the spines. The anal is of about the same shape and size as the soft dorsal, but begins a little behind it. The pectorals are tapering, about equal to the head in length, their tips not reaching origin of anal, but to origin of soft dorsal; ventrals united, free from the belly, inserted behind the pectorals, but their tips not reaching tips of pectorals.

Teeth apparently, in a single species, small and weak.

Ground color pale yellowish, thickly mottled with fine punctulations of dark; about seven pretty well-defined larger spots of dark brown along middle of side; eight or nine faint cross-bars of lighter, a number of small light spots scattered irregularly over the sides; head dark; dorsal, anal, and ventral fins covered with fine black points, in some specimens the dorsals and anal being quite dark; pectorals plainer; caudal similar to the ventrals.

This species seems most closely related to *G. pocyi* Steindachner, but differs in that the head is less flat, the interorbital space is less wide, the fewer scales, as well as differing in color.

Seven specimens were obtained from shallow water in the bay at Guaymas. This species seems to be one of the smallest of the gobies, the largest of our specimens being but 27^{mm} long.

10. **Gobius longicaudus**, sp. nov. (Type No. 39636, U. S. N. M.)

(Length of longest specimen, 15^{cm}.) Head 5 in length to base of caudal ($7\frac{1}{4}$ in total); depth, 7 (10); eye, $4\frac{3}{4}$; D. VI–13; A. 13; scales about 66 in longitudinal, 15 in transverse series, counted just below space between the two dorsals. Body slender, tapering pretty regularly from middle of first dorsal to caudal, most compressed posteriorly, depth about uniform from head to origin of second dorsal. Head short, depressed, and broad, $4\frac{1}{2}$ to 5 in length in twelve specimens measured, $5\frac{1}{2}$ to $7\frac{1}{4}$ in total length of fish; maxillaries rather short, 3 in head, reaching about to middle of eye, wide apart, the distance between them

at their posterior ends being greater than their length, or about two-fifths length of head; mouth but little oblique. Eye small, $1\frac{1}{2}$ in snout, $4\frac{3}{4}$ in head, twice the interorbital space. Teeth in a narrow band in each jaw, those in upper largest. Pseudobranchiæ in seven tufts, well developed. Gill-rakers short and flexible, rudimentary on all but first arch. First dorsal of six rather weak spines, their length about three-fifths that of head; origin of first dorsal over middle of pectorals, distance from snout equals $1\frac{1}{2}$ times length of head. Distance between dorsals less than diameter of eye. Origin of second dorsal in most specimens examined a little nearer tip of snout that base of caudal. Pectorals moderate, $1\frac{1}{4}$ in head, their tips reaching past middle of spinous dorsal. Ventrals inserted below pectorals, about equal to them in length, reaching more than half way to origin of anal. Beginning of anal immediately below that of second dorsal; the two fins are of almost equal length, the anal extending a little nearer the caudal; the anal fin is less high than the dorsal. The caudal fin is quite long, two times in length of body in largest specimens, $2\frac{1}{2}$ in smaller ones, its relative length increasing with age. Entire head scaleless, predorsal region with small scales; body covered with close-set ctenoid scales, small and greatly crowded anteriorly, toward the caudal fin growing gradually larger and more strongly ctenoid, but fine rows of scales in a transverse series on the caudal; peduncle fins naked.

General color light-yellowish, palest below, upper parts darker; sides with a series of fine rather distinct black blotches; the first is under the first dorsal, the second under origin of second dorsal, the third, which is sometimes almost double, at about the middle of the second dorsal, the fourth near its posterior end, while the last and largest is at the base of the caudal. There is a large black spot upon each shoulder just above the origin of the pectoral fin; head plain, inclining to dark above; lips with a little dark; maxillary dark; opercle with a dark blotch. Dorsal fins with a few dark spots; anal unmarked; pectorals dotted with dark brown; ventrals plain; caudal crossed by six or seven dark zig-zag bars.

This species is related to *G. sagittula* (Günther), from which it differs chiefly in the longer tail, smaller scales, smaller eye, and in coloration, especially in the presence of the large blotches upon the body and the markings of the fins.

It may be readily distinguished from *G. oceanicus* Pallas, by the somewhat shorter caudal, the wider and more depressed head, the greater width of space between rami of the mandible, and the absence of the black spots upon the first dorsal spine.

About forty specimens of this species, varying in length from 6^{cm} to 15^{cm}, were taken in a small shallow arm of the bay near Guaymas.

11. Gillichthys y-cauda, sp. nov. (Type, No. 39637, U. S. N. M.)

Head $3\frac{1}{2}$ (4); depth 7 (8); eye $3\frac{1}{2}$; D. V—16; A. 15; Lat. l. about 50, about 18 in transverse series; B. 5.

Body moderately elongate, compressed, narrowing regularly from the shoulder-girdle to the caudal fin; head not greatly depressed, broader than body, its length being contained four times in total length of body; snout rounded, short, about equal to diameter of eyes; interorbital space narrow, not greater than half diameter of eye; mouth rather large, its gape extending nearly to the vertical of posterior margin of orbit; maxillary somewhat variable in length, but usually prolonged behind eye for a distance nearly equal to diameter of eye; skull rather long, medium crest of cranium moderate, cross-ridge across posterior part of interorbital space well developed; scale small, cycloid, about fifty in longitudinal series, eighteen in transverse; teeth in a single series on premaxillaries and mandible short, blunt, and curved slightly backward, most closely set and most numerous on premaxillaries.

Fins moderate; dorsal of five spines and sixteen soft rays, the spines being unconnected with the rayed portion, the space between them about equal to half diameter of eye; the spines are weak and flexible, their length being one-half that of the head; soft dorsal begins at a point a little nearer end of snout than tip of caudal, and extends nearly to the caudal, its height is about equal to that of the spinous portion, the first few rays being slightly graduated; the anal has fifteen rays and begins a little behind the origin of the soft dorsal, the rays are about equal to those of the dorsal in length; pectorals moderate, inserted a little below the axis of the body, their length greater than the depth of the body, their tips reaching a vertical from posterior part of spinous dorsal; ventrals united but not adnate to the belly, inserted slightly in front of the pectorals, and their tips do not quite reach those of the pectorals.

Ground color light, head and body pretty uniformly covered with dark punctulations; an irregular dark bar across occiput; breast and belly pale; a row of nine or ten small dark blotches along the middle of the side, the one at the base of the caudal being plainest and having a shape something like the Greek letter *Γ*; about six dark blotches along median line of back. Peritoneum dark.

The average length of over seventy specimens is about 33^{mm}, the longest 40^{mm}.

This species is allied to *G. guaymasiæ* J. & E., from which it differs, among other points, in its smaller size, shorter head, and its fewer fin-rays.

Numerous specimens of this little fish were found rolled up in the seaweed dragged out by the seine from the bay near the railroad station at Guaymas.

12. Gillichthys guaymasiæ, sp. nov. (Type, No. 39642, U. S. N. M.)

Head 3 in length to base of caudal ($3\frac{3}{5}$ in total); depth 6 (7); D. V–14; A. 13; eye, 5.

Body quite slender, elongate, but little compressed; head long, narrow, not much widened behind the eyes, not depressed, forming one-

third the length to base of caudal. Profile gently arched from snout to half the distance to dorsal fin, from there nearly straight to dorsal, and then gently curved to caudal peduncle; ventral outline nearly straight; a considerable prominence on the snout made by the enlarged end of the turbinal bone. Eye somewhat above median line, not quite equaling the snout in length; interorbital space narrow, it being contained one and one half times in the eye. The maxillaries are much produced, in some specimens nearly reaching the gill-openings, broadest at the middle and tapering to a blunt point posteriorly; premaxillaries not protractile, but little movable at the symphysis, more than half as long as the maxillaries. Gill-rakers, two above the angle, ten below, short and blunt, the first four the largest, those on the second arch but little developed. Teeth well developed, in a single series, on mandible and premaxillaries, all slightly curved backwards.

The tongue is not so broad as in *G. mirabilis* Cooper; it is gently rounded at the tip, which is free for a much greater length than in *G. mirabilis*. The peritoneum is black or blackish, and the intestine short, but little longer than the head, and not at all convoluted.

The scales are small, imbedded, and scarcely perceptible except on sides; no pores appear to be developed. First dorsal of fine flexible spines, distance of origin from snout $2\frac{2}{5}$ length of body, and separated from the second dorsal by a distance but little greater than length of snout; second dorsal of fourteen rays of nearly equal length, which equals the distance from end of snout to middle of pupil; length of base of soft dorsal not quite equal to length of head, distance of posterior end from caudal fin equals distance between the two dorsal fins. Origin of anal behind that of soft dorsal and a little posterior to middle of total length of fish; its base is contained one and one-fourth times in base of soft dorsal, or about four times in length of fish to base of caudal fin. Pectorals moderate, a little more than half length of head. Ventrals inserted slightly behind the pectorals and about equaling them in length.

Color in life, whitish beneath, grayish or mottled above; six double white spots along the back, alternating with fine blackish areas; a white spot behind each eye on top of head, cheeks with two dark bands extending obliquely backward and downward from eye, a number of dark splotches on opercles; about seven dusky areas along the side, the last and most marked being upon the base of the caudal fin. Dorsal fins finely marked lengthwise by about four series of small dark spots; caudal crossed by five or six wavy vertical bars of very fine dark spots or points; anal, pectorals, and ventrals plain. In alcohol these markings are less plain, especially the white and black areas upon the back.

This species is related to *G. mirabilis* Cooper, from which it may be readily distinguished by the fewer dorsal spines, the greater number of anal rays, the more slender body, narrower head, and difference in color.

The species is based upon twenty specimens, the longest 70mm in length, obtained by us from a lagoon near the Long Bridge above Guaymas, and from a small arm of the bay near the city. The water in both places was shallow, and quite filthy from great quantities of dead fishes that had been washed in.

An examination of the material at hand leads us to believe that the newly-proposed genus *Clevelandia** was based upon characters that are not of generic value, and can not therefore stand. In *Gillichthys* the number of dorsal spines has been invariably given as six. The fact that the number of dorsal spines in *Clevelandia* and in our specimens, which will agree otherwise with *Gillichthys* as limited by Cooper, are four and five, respectively, would seem to indicate that the limits of the genus *Gillichthys* should be extended. This is evidently preferable to basing a new genus upon so slight a character as a difference of one or two dorsal spines.

13. Scorpæna sonoræ, sp. nov. (Type, No. 39644, U. S. N. M.)

Head, 2½ in length to base of caudal (3 in total); depth, 3½ (4½); eye, 3; D. XI, I—10; A. III—5; Lat. l. 6—47—15.

Allied to *S. fernandeziana* Steindachner.

Body oblong, slightly compressed, back not greatly elevated, profile gently arched from snout to origin of first dorsal, and but little convex from there to caudal fin; ventral profile nearly straight to origin of anal, where it makes a broad angle with line to base of caudal.

The occiput has no distinct pit; there is no pit between the lower anterior margin of the orbit and suborbital stay.

Head large, little compressed, 3 in total length. Mouth large, oblique; maxillary large, triangular, 2½ in head, extending to posterior margin of pupil; premaxillaries with a deep sinus at the middle of their anterior margin into which fits the slightly projecting lower jaw.

Teeth in villiform bands on jaws, vomer, and palatines. Suborbital with a sharp ridge bearing three small spines, these in a line with a strong spine on the preopercle.

Cranial ridges quite unlike those in *Sebastodes*. The nasal spines small with a prominence between them made by the upper posterior tips of the premaxillaries; the preocular spine is the largest; the supraocular ridge with two small spines a little behind middle of eye; on the upper posterior margin of the orbit is a strong tubercle rising into three small spines from which a well-developed occipital ridge extends backwards, ending in a sharp spine; tympanic spines quite small; coronal ridges quite prominent, with at least three distinct spines on each; nuchal spines well developed.

Opercle with two strong spines, both beginning at the same point on a level with the pupil and at a distance from it equal to the diameter of the eye, the lower one running nearly horizontally backwards across

* Eigenmann and Eigenmann, Proc. Cal. Acad. Sci., 1888, 73.

the opercle, while the upper and weaker one diverges from it at an angle of about thirty degrees and extends to the lateral line; the length of each of these spines is equal to the diameter of the eye.

There are five preopercular spines, the uppermost one much the largest, in a line with the suborbital ridge, and with a very small spine on its ridge near the middle; the second, or next spine below, is very short and inconspicuous; the third is short and broad and projects slightly downwards; the fourth is smaller than the third and is inclined still more downwards; while the fifth is still smaller and projects nearly at right angles with the first.

The suborbital ridge prominent, bearing two small spines, the anterior one directly beneath the pupil the other at anterior edge of the preopercle.

Origin of spinous dorsal a little in front of opercular flap, its distance from snout three times in body to base of caudal; first spine short, less than snout in length; second spine equals eye; third equals distance from tip of snout to middle of pupil; fourth, fifth, and sixth each a little longer; the remaining four gradually shorter, the eleventh about as long as first, thus making the fin emarginate; all rather strong and pungent; the next spine slender, greater than eye in length; the ten soft rays moderate, about equal to third spine in length; distance from base of dorsal to caudal not equal to height of the former. Anal moderate, its height a little greater than its length, its origin under beginning of soft dorsal; the first spine shorter than second spine of the dorsal, the second much stronger and longer, one-half length of head, longer than longest dorsal spine; third more slender, shorter, about equal to longest dorsal; soft rays about equal to longest spine; anal and dorsal fins equally distant from the caudal.

Pectorals long, 1.3 in head, their tips just passing first anal spine, inserted a little in advance of the ventrals and much below the axis of the body; the upper rays branched.

Ventrals close together, moderate, just reaching vent. Caudal moderate, about equal to the pectorals in length.

Cheeks well scaled, opercles nearly naked, occipital region with a few poorly developed scales; body covered with moderate cycloid scales, about 47 in longitudinal and 21 in transverse series; the lateral line begins at the upper angle of the opercle, then curves downward to a line vertical from the tips of the ventrals, and then upward to near the middle of base of soft dorsal, from which it is nearly straight to the caudal fin; but few dermal flaps upon scales.

Coloration, in alcohol: Body pale below, dark above, mottled with darker; head dark, snout and jaws covered with fine punctulations; a dark blotch between the eyes, an irregular blotch extending from below eye to edge of opercle, and another on suborbital just below pupil. Spinous dorsal with three dark blotches at base extending onto the body, outer edge mottled with black; soft dorsal with a dark spot at

the base, a black spot greater than the diameter of pupil on the middle of the outer part, and another on the tips of the last rays. Pectorals with two distinct black bars and mottled with black near the base, the narrow outer edge white; axilla pale; ventrals white on anterior half, the terminal half black; anal white, tips of last rays with a black spot; caudal with three black bands, the first partly on the peduncle, the second about equal to half the eye in width, its posterior edge at middle of fin; the third on tip of fin, about equal to snout in width.

This species is related to *S. fernandeziana* Steindachner, from which it differs chiefly in being not so deep, in the naked temporals and opercles, and in coloration.

One specimen, 63^{mm} long, from Guaymas.

14. Gnathypops scops, sp. nov. (Type, No. 39641, U. S. N. M.)

Head, 3.5 in body to base of caudal; width of head 5.75, its depth 4.6; dorsal spines and soft rays, 26; anal spines and soft rays, 19; scales, 3–122–40.

Scales small; none on head. The lateral line extends to about middle of dorsal fin. Mouth large. Maxillary extends beyond the eye a distance equaling 4.1 in head. The snout is 6.5 in head. Teeth in bands, and on the upper jaw the outer series is rather strong. A single tooth on the vomer. The gill membranes are connected.

The opercles end in long flaps, which extend upwards and backwards, nearly meeting over the back in front of the dorsal fins.

Eye large; 2.5 in head. The interorbital space narrow; 11 in the head.

There is no depression between the dorsal spines and the soft rays; height of dorsal equals that of anal.

Ventrals inserted in front of the pectorals; the pectorals equal the ventrals in length, being 7 in the body length; caudal rounded.

Coloration, in alcohol: Body pale, covered with many dark spots about the size of three to six scales. The top of the head with smaller dark spots; the sides of the head with whitish spots. The dorsal fin with a black ocellated spot equal to the diameter of the eye on the space between the second and fifth spines, the remainder of the fin dark, with many white spots running into each other on some portions, so as to form irregular lines. Base of the anal fin pale; the outer edge black. The caudal fin is dark, with two whitish spots at the base, and a row of six white spots across the middle on alternate rays. Pectorals lighter, with small whitish specks; ventrals dusky; belly pale.

Three specimens were obtained from the bay at Guaymas, respectively 115^{cm}, 10^{cm}, and 7^{cm} in length to base of caudal.

Measurements.

	Millimeters.	In body.	In head.
Length of body to base of caudal	115		
Depth of body	25	4.6	
Length of head	33	3.5	
Depth of head	25	4.6	
Width f head	20	5.75	1.7
Width of body at front part of dorsal	12	9.5	
Eye	13		2.5
Interorbital space	3		11.0
Snout	5		6.5
Maxillary beyond the eye	8		4.1
Pectoral fin	16	7.0	
Ventral fin	16	7.0	

15. Opisthognathus ommata, sp. nov. (Type, No. 39640, U. S. N. M.)

Head 3 in the length of body to the base of the caudal; in total length 3.75. The width of head, 5. The depth 5 in body to base of caudal; depth of body, 4.15; width, 8.3 in length of body; dorsal spines and rays, 28; anal spines and rays, 18; scales in longitudinal series, about 140; branchiostegals, 6.

Body moderate, compressed, depth 4.15, width behind the head 8.3 in the length of the body. Head large, its breadth equaling its depth, being 5 in the length of the body.

Scales small, embedded, head naked, lateral line extending past the middle of the dorsal fin. Mouth large.

Maxillary long, 1.5 in head; postorbital portion 2.3 in head, not extending beyond the head. The snout short, its length less than half the diameter of the eye; the distance from tip of snout to the end of maxillary is contained 3.3 in the length of the body and 1.2 in the head.

Teeth in front part of each jaw in several series; on sides of jaws reduced to a single series; the outer series strong. A to th on the vomer.

The gill membranes are connected.

Eye 3 in head, the interorbital space very narrow, 11.6 in head.

Distance from snout to origin of dorsal but little greater than length of head; space between dorsal and caudal fins one-half greater than the length of snout. There is no depression between the spinous and soft rays of the dorsal fin, the dorsal equaling the anal in height; its longest ray is 1.66 times the eye.

The pec orals are slightly longer than the ventrals, being 2 in head; the breadth of the pectorals is 3 in the head.

The ventrals are inserted slightly in front of the pectorals.

The caudal is rounded and narrow.

Coloration: The body is irregularly mottled with dark, head evenly blackish. The dorsal fin is blackish on the posterior portion, with two rows of four or five pale spots well separated. There is a large ocellated spot from the third to the sixth spines, including them, greater than the diameter of the eye. Anal fin black, with a series of pale spots on the

rays, the base pale. Caudal black, with two pale spots at the base and a row of spots across the middle. The lining of the maxillary with bands of black and white.

This fish differs from *O. punctata* Peters, to which it is allied, in the evenly black head, in the presence of a large ocellated spot on the dorsal fin, and in the coloration of the remaining part of the dorsal, in the coloration of the remaining fins, in the smaller scales, in having a tooth on the vomer and in the shorter maxillary.

Three specimens were obtained in the bay at Guaymas.

Measurements.

	Millimeters.	In body.	In head.
Body:			
Length to base of caudal	108		
Depth	26	4.1	
Width behind the head	13	8.3	
Head:			
Length	35	3.0	
Width	23	5.0	
Depth	23	5.0	
Interorbital space	3	11.6	
Tip of snout to tip of maxillary	28	3.3	1.25
Maxillary beyond the eye	15		2.3
Eye	11		3.0
Ocellated spot on dorsal	14		2.5
Pectoral fin	17		
Ventral fin	16		
Lateral line	42		

16. Auchenopterus asper, sp. nov. (Type, No. 39643, U. S. N. M.)

Head 3 in length to base of caudal ($3\frac{2}{3}$ in total); depth, $5\frac{1}{2}$ ($6\frac{1}{3}$); eye, $4\frac{1}{5}$ in head. Lateral line, 6—43—7; D. III, XXV—1; A. II—20.

Body greatly compressed, head narrow, pointed, snout long, lower jaw slightly the longer; mouth a little oblique, cleft moderate, maxillary not reaching nearly to vertical at front of orbit. Teeth in one well-defined outer series and a broken inner one; those in the outer series are strongest and of pretty uniform size, short and broad. Vomerine teeth in a single patch; no palatine teeth. No tentacles of any kind about the head. Profile nearly straight from snout to origin of first dorsal, but very slightly arched from there to base of caudal fin.

The scales are rather large, cycloid, about forty-three in a longitudinal series, upon about forty of which pores are well developed; about six rows between the origin of the second dorsal and the lateral line just behind its angle, and about seven from there to middle of ventral surface; nine rows from origin of second dorsal to upper limb of opercle; entire head, opercles, and fins naked.

Lateral line, beginning at upper limb of opercle on a level with the pupil, almost exactly under the middle of the first dorsal fin, and a little more than one-fourth the distance from top of nape to the under side of the throat, arches gently for seven or eight scales, leaving but one row of scales between it and the first spines of the second dorsal; on the ninth, tenth, and eleventh scales it bears slightly downward until

two rows are left between it and the dorsal, then a sharp turn is made which puts it four scales further down, and from there it pursues a nearly direct line to the middle of the base of the caudal fin.

There are two distinct dorsal fins, the first composed of three slender, flexible spines, their length being contained about twice in that of the head. The second dorsal is separated from the first by a distance somewhat greater than the diameter of the eye, and is composed of twenty-five rather stout, sharp spines and one terminal soft ray; the first three are graduated, the first being contained one and one-half times in the distance between the two fins, the second is about one-half longer, and the third still a little longer; the remaining twenty-two are of approximately equal length, about equaling the distance from the origin of the first dorsal to that of the second. The one soft ray is somewhat shorter than the spines, and is well separated from the caudal by a space equal to that between the dorsals. Pectorals inserted under middle of space separating the dorsals, composed of fourteen rays, equaling eye and snout in length, and reaching slightly past origin of anal. Ventrals of two rays inserted directly under origin of first dorsal and considerably in front of pectorals, which they somewhat exceed in length, in some specimens reaching vent.

The anal fin begins slightly in front of posterior end of the pectorals, is a little lower than the second dorsal, and reaches a trifle nearer to the caudal fin; the first spine is longer and more slender than the first regular dorsal spine, while the second equals the third dorsal in length. The caudal fin is rounded, and in length equals the greatest depth of the fish.

Coloration (in alcohol), pale, pretty regularly covered with very fine dark punctulations, thickest on the back, palest below; a large dark opercular blotch, two similar postocular blotches, and usually a darkish bar extends downward from the eye; upper half of preorbital region dark, outer margin of jaws dark, breast and under parts of head pale, top of head and nape dark. First dorsal quite dark, almost black; second dorsal pale, obscurely mottled with brown, which is disposed in about five indistinct areas; a large black ocellus upon the twelfth and thirteenth spines of the second dorsal, and a similar one upon the twenty-third and twenty-fourth spine; each ocellus is surrounded by a narrow circle of white or pale orange. In the six specimens before us there is a slight variation as to the exact position of the two ocelli; in one example the second ocellus extends back upon the twenty-fifth spine also; but in every case the twelfth and thirteenth, and the twenty-third and twenty-fourth, are the spines which most evidently locate the spots. Pectorals and ventrals plain; anal paler than dorsal, sparsely covered with fine dark points, so grouped as to form three or four darker areas.

The description of this specimen is based upon six specimens (the largest 57^{mm} long), taken from the mass of kelp hauled out by the seine from the bay near Guaymas.

This species may be distinguished from *A. monophthalmus* Günther*

---

* Günther, Cat. Fishes, Vol. III, 275.

by the absence of tentacles about the head, the presence of *two* dorsal ocelli instead of one, the absence of any membrane connecting the two dorsal fins, the presence of a terminal dorsal soft ray, and in the greater number of scales in the lateral line.

From *A. altivelis* (Lockington)* it differs in the greater length of the head, the smaller scales, and the position of the dorsal ocelli, which in *altivelis* are upon the fourth and twenty-fourth and twenty-fifth rays instead of the twelfth and thirteenth, and twenty-third, and twenty-fourth spines. From Mr. Lockington's description it seems that, in *altivelis*, there are no detached dorsal spines, which is another important difference.

From *A. integripinnis* (Rosa Smith)† it differs in the two distinct dorsals, the presence of two dorsal ocelli, as well as in other less important points.

17. Psednoblennius hypacanthus, gen. et sp. nov. (*family Blenniidæ*). (Type, No. 39638, U. S. N. M.)

Head, $4\frac{2}{3}$ in length to base of caudal (5 in total); depth, 7 (8); eye, 4, = snout; B. 6; D. III, 34; A. 27.

Body greatly compressed, moderately elongate, its depth but eight times in total length; head short, snout blunt, about equal to eye; anteorbital profile very steep, gently rounded from front of eye to first dorsal, from there nearly straight to caudal; ventral line nearly straight. Body naked, no membranous appendages. Mouth large, horizontal, jaws subequal, extending to beyond middle of eye. Teeth in a single series in both jaws, well developed, pretty uniform in size, slightly projecting backward; vomer and palatines apparently smooth. Eye large, equal to twice interorbital space, high up. Dorsal fins two, the first of three very slender, flexible spines, hard to distinguish from soft rays, but they do not appear to be at all jointed. This fin is inserted upon the nape immediately above the posterior edge of the preopercle, and a distance in front of second dorsal nearly equal to the length of the snout; its very soft spines equal in length the distance from end of snout to posterior rim of orbit. The second dorsal begins directly over the origin of the pectorals and extends to the caudal, with which it is slightly connected. The first few rays of the second dorsal are very weak, flexible spines, the last few are pretty evidently soft, jointed rays, while the intermediate ones are not distinguishable as definite spines or soft rays—in short, there seems to be a gradual change from spines to soft rays from the anterior to the posterior part of the fin. This character, if we mistake not, is entirely unique. The fin is of nearly uniform height, the rays about equaling those of the first dorsal in length. The anal is similar to the second dorsal in shape and height but is much shorter, its origin being much behind that of the second dorsal or nearly half way from the snout to the base of the cau-

* *Cremnobates altivelis* Lockington, Proc. Acad. Nat. Sci. Phila., 1881, pp. 116–118.

† *Cremnobates integripinnis* Rosa Smith, Proc. U. S. Nat. Mus., 1880, 147–149.

dal; posteriorly it extends coterminously with the dorsal, and, like it, is slightly joined to the caudal fin. Caudal fin apparently rounded, fan-shaped, but its shape can not be exactly made out, as some of its rays are broken off.

The pectorals are inserted below the axis of the body, directly over the ventrals; their length about three-fourths that of head. Ventrals of two rays, inserted under the pectorals, about equal to pectorals in length. The body is entirely scaleless. Coloration (in alcohol), pale, mottled with fine dark points so arranged as to inclose circular areas with fewer spots; a long dark blotch behind the axil, inclining downward and backward; head covered with similar punctulations; opercles dusky; chin with two dark cross-lines, separated by one of white, extending onto upper jaw on each side; top of head with a purple spot; sides with a series of about six short black lines, the last broadest and plainest; base of caudal with a distinct black blotch. First dorsal quite dark, almost black; second dorsal with about eight pretty well defined dark blotches at its base, rest of fin with numerous dark spots of different sizes; anal with about twelve dark blotches extending somewhat regularly from the base slightly forward, these separated by plain unmarked spaces of a little greater width; caudal sparingly marked with dark points arranged in wavy cross-bars; pectorals and ventrals unmarked.

A single specimen, 40^{mm} long, was obtained by us from a shallow arm of the bay at Guaymas.

The species evidently belongs in the family *Blenniidæ* and would seem to be related to the genus *Pholidichthys* Bleeker. The many important points in which it differs from this genus, as well as from all other genera that are at all related to it, seem to us to necessitate its being made the type of a new genus, *Psednoblennius*, the characters of which are included in the foregoing description. (Ψεδνός = naked; βλέννος = blenny.)

18. Citharichthys gilberti, sp. nov. (Type, No. 39627, U. S. N. M.)

Head, 3.5 in length of body to base of the caudal; the depth of head 4 in body; width of head, 20; depth of body, 1.9 in length; thickness of disc, 11.8 in length of body; dorsal, 78; anal, 57; scales, 18—46—19.

Body comparatively broad; the greatest depth is under the middle of the dorsal; the two profiles about equally arched; the snout slightly longer than the longest diameter of the eye, and without a distinct spine.

Eyes on the left side, equal in size, small, 5.7 in head; interorbital space narrow, 19 in head, low, slightly grooved, and scaled on posterior portion only.

Maxillary, 2.4 in head, reaching barely to posterior border of the eye, upper jaw projecting.

Teeth small, in a single series; none on the vomer.

Gill-rakers on anterior arch 4—13, not strong, with a rather broad base, quickly narrowing to a slender stalk, much weaker on second and third arches; obsolete on posterior arch.

The dorsal fin begins in front of the anterior margin of the upper eye, the first three rays growing from the blind side, the distance of the origin from the snout being seven times in the length of head. Fin rays all simple.

The anal fin begins on a vertical through the axilla at a distance from the snout 0.8 in the head; its greatest height is 2.3 in head.

The two pectorals are nearly equal, the one on the colored side being slightly longer, its length 1.9 in head, its distance from snout 0.8 in head, the insertion less than one-third the distance below the lateral line. The rays on colored side, 9; on blind side, 8.

The ventrals are 2.3 in head, their origin from snout nearly equaling the head.

Caudal rounded; caudal peduncle short, its depth 8 in the body, equaling the height of the anal.

Scales large, ciliated, tolerably uniform, those towards the head and the margins of the disk becoming smaller, the largest scales about equaling the diameter of the eye.

Lateral line simple, gradually descending along the course of about 16 scales, from which point it is straight.

Color light brown, with about 15 irregular dark blotches of various sizes, the largest being a pair on the latter third of the disc, one on each side of the lateral line. as great in diameter as the length of the ventral fin.

One specimen, 20^{cm} in length, was caught in the bay at Guaymas.

This species is dedicated to Prof. Charles H. Gilbert, whose collection and notes on fishes from Mazatlan, containing undescribed species, this among them, was destroyed by fire in 1883.

Measurements.

	Millimeters.	In body.	In head.
Length of body to base of caudal	200	....	....
Depth of body	105	1.9	....
Thickness of body	17	11.8	....
Depth of caudal peduncle	25	8	....
Length of head	54	3.5	....
Depth of head	52	4	....
Thickness of head	10	20	....
Interorbital space	3	....	....
Snout	11	....	5
Tip of snout to end of maxillary	24	....	2.25
Eye from front to back	10	....	5.4
Dorsal fin	....	....	....
Height	21	....	2.6
Distance of origin from snout	8	....	6.75
Anal fin	....	....	....
Height	25	....	2.16
Distance of origin from snout	74	....	.73
Pectoral fin	28	....	1.9
Origin of pectoral from snout	60	....	.9
Ventral fin	22	....	2.5
Origin of right ventral from snout	52	....	....

O. P. JENKINS,
Greencastle, Ind.
B. W. EVERMANN,
Terre Haute, Ind.

JULY 2, 1888.

DESCRIPTION OF GEOMYS PERSONATUS AND DIPODOMYS COMPACTUS, TWO NEW SPECIES OF RODENTS FROM PADRE ISLAND, TEXAS.

BY FREDERICK W. TRUE.

In a small collection of dry skins of mammals from Padre Island, Texas, recently purchased by the Museum from Mr. C. K. Worthen, of Warsaw, Ill., are three specimens which are apparently the representatives of two new species of rodents, belonging respectively to the genera Geomys and Dipodomys. For the first of these, I have chosen the name of

GEOMYS PERSONATUS. (New species.)

Description.—Size and proportions of *G. bursarius*. Color above, pale pinkish brown, corresponding to the color termed "Broccoli brown," in Mr. Ridgway's "Nomenclature of Colors," with the addition of a little burnt sienna. This color is darkened along the median line of the back, where the tips of the hairs are sepia colored. On the flanks the clear light-brown shades gradually downwards into pure white, which is the sole superficial color of the under surfaces of the body. On the breast, chin, and the inner sides of the legs, and along the median line of the belly the hairs are pure white to the roots, but elsewhere their basal portion is plumbeous. A well-defined dusky band occupies the space between the eyes and extends thence to the nostrils; but the few hairs immediately beneath the nostrils are white. The hairs on all the feet and on the upper surface of the distal half of the fore-arm and crus are white to the roots, but higher up on the limbs they become plumbeous at the base and light brown toward the tip, like the hairs of the upper surface of the body. The tail is very sparsely clothed with white hairs, the distal half being almost naked. Feet and ears as in *G. bursarius*.

The superior incisors are grooved precisely as in *G. bursarius*.*

Measurements. (From the collector's notes, except those for the feet.)

Measurements.	♂ (Collected April 11, 1888.)	♀ (Collected April 11, 1888.)
	Centimeters.	*Centimeters.*
Length of head and body	21.0	21.6
Length of tail	7.3	7.8
Height of ear (from behind)	0.3	0.25
Length of fore foot (with claws)	3.1	3.2
Length of longest claw	1.7	1.8
Length of hind foot (with claw)	3.2	3.3

This species is evidently closely allied to *G. bursarius*, of which, indeed, it may eventually prove to be a geographical race. I know of no

* The cranial characters can not be given at this time, owing to the fact that the collector neglected to remove the skulls from the skins. To attempt to remove them now would be to sacrifice the skins.

specimens, however, which may be regarded as intermediate, unless it be those on which Baird founded his *G. breviceps*. In that species the under parts are nearly white, but the species is distinctly smaller, and has the head colored like the upper surface of the body.

The second new species, which belongs to the genus *Dipodomys*, on account of its thick-set body and short legs, may be called

DIPODOMYS COMPACTUS. (New species.)

Description.—Hind toes five; form stout; tail and hind legs shorter than in the other species of the genus. Hind foot shorter than the skull, its length less than one-third the length of the head and body; tail vertebræ equaling the head and body in length. Ears moderate and rounded.

Upper surfaces pale, pinkish buff, suffused along the back and head with sepia-color. The under surfaces of the body, the entire fore limbs, and the hind limbs, except a limited area on the outside of the thigh, pure white. The oblique, white thigh-band, which occurs in all the species, is here distinctly limited anteriorly by the sepia-colored tips of the short hair of the rump, and extends to and embraces the root of the tail. The pure white of the under surfaces extends high up on the sides of the face, broadly encircling the eye and extending between the eye and ear, and behind the ear itself for a distance of about twice the length of the latter.

Sides of the tail, and the distal half of its under surface, white; upper surface, including the terminal pencil, with an irregular band of pale sepia-color. Proximal half of the under surface with a similar, but very pale and indistinct, band. Median line of soles with only a faint trace of pale sepia-color. Ears sparsely clothed internally and externally with longish white hairs, except in a small area on the exterior surface of the superior margin, where the hairs are gray.

Mystacial bristles of two colors, white and sepia; claws white.

Measurements. (*From the collector's notes, except that for the hind foot.*)

Measurements.	♀ (Collected April 3, 1888.)
	Cm.
Length of head and body	10.5
Length of tail	11.45
Height of ear (from behind)	0.65
Length of fore foot (with claw)	....
Length of hind foot (with claw)	3.1

This species differs from all the forms thus far described in the shortness of its tail and hind limbs and in the amount of white on the sides of the head and the hind legs. The pallor of its coloration is doubtless correlated with the aridity of the region it inhabits, as in the case of *Dipodomys deserti* and the species of *Geomys* just described, but the proportions of its limbs, ears, and tail, and the distribution of its colors, indicate that it is something more than a geographical race.

ON THE SAN EMIGDIO METEORITE.

BY GEORGE P. MERRILL.

(With Plate xxxv.)

The stone here described has already been the subject of a brief paper in the columns of the American Journal of Science.* As there stated, the fragments came into my possession through the kindness of Mr. Thomas Price, of San Francisco. The stone is stated by Mr. Price to have been found by a prospector in the San Emigdio Mountains, San Bernardino County, in the southern part of California, and to have been sent him for assaying, it being mistaken for an ore of one of the precious metals; unfortunately, before its true nature was discovered the entire sample received was put through a crusher and hence pieces larger than a few grains' weight are unobtainable. Nothing whatever can be learned regarding the fall of the stone, and its meteoric origin is assumed from its structure, composition, and the presence of the well-known black coating on the exterior surfaces of many of the larger particles. The weight of the entire mass was stated by the finder to be about 80 pounds.

All the fragments received are stained throughout a dull reddish-brown color through the oxidation of the metallic portions. The stone breaks with an irregular fracture, and presents on casual inspection nothing indicative of its meteoric origin; a polished surface, however, shows abundant silvery white flecks of metallic iron in sizes rarely over one millimeter in diameter, and numerous larger spherical bodies of a green color suggestive of olivine. These last, so far as observed, are never over 2 or 3 millimeters in diameter.

In the thin section the true nature of the stone is at once apparent. As seen under a power of fifty diameters its appearance is as indicated in Figs. 1 and 2, Pl. xxxv. A large number of rounded and irregular chondri and crystal fragments with scattering blebs of metallic iron and pyrrhotite, imbedded in a groundmass the true nature of which is so badly obscured by ferruginous stains as to be almost irresolvable, but which from a study of the thinnest slides obtainable, I am inclined to consider as fragmental. This irresolvable groundmass I have indicated by the dotted areas in the two figures.

The readily determinable constituents named in the order of their abundance are olivine, enstatite (bronzite), metallic iron, and pyrrhotite; there are also occasionally very minute fragments of an almost

* On a new Meteorite from the San Emigdio Range, San Bernardino County, Cal., by George P. Merrill. American Journal of Science, June, 1888, p. 190.

Jan. 5, 1889.

completely colorless mineral, which between crossed nicols shows evidence of polysynthetic twinning. These are too small and irregular for accurate determination, but from certain indefinite and obscure characters I have felt inclined to regard them as belonging to a mineral of the pyroxene group rather than as a plagioclase feldspar. Their appearance resembles very closely that of the twinned magnesian pyroxenes obtained by Messrs. Fouquè and Lèvy in artificial meteorites, and shown in Fig. 1, Plate IV, of their paper.*

THE OLIVINES.--These occur in the form of both monosomatic and polysomatic chondri and as scattered fragments in the groundmass. The chondri show a variety of structural features; common forms are those shown in Figs. 1 and 2 (see explanation of plate), and also in Figs. 7, 8, and 9. In certain cases they are made up wholly of crystalline granules of olivine with scarcely a trace of amorphous matter, or again show well developed porphyritic crystals imbedded in a very finely granular or even glassy base, or again show a very finely granular almost dust-like and very obscure structure throughout. The porphyritic olivines are perfectly clear and colorless, with but few cavities or inclosures, though sometimes including portions of amorphous base. Forms are abundant resembling the polysomatic chondri figured by Tschermak † from sections of the Mezö-Madaras, the Homestead, and the Seres meteorites. They are not in all cases circular in outline, as seen in the section, but are often irregular and fragmental in appearance, as shown particularly in Figs. 7, 8, and 9. Monosomatic forms, as shown in the upper right portion of Fig. 1, and just to the right of the large enstatite fragment in Fig. 2, are common. These, as a rule, show a more nearly spherical outline than do the polysomatic forms. Occasional monosomatic grate-like forms are met with in which the cross-bars are curved, as figured by Reusch ‡ from sections of the Tysnes meteorite, but they very rarely show the colorless border or rind as in the case mentioned. Such forms, as a rule, extinguish simultaneously in all portions, but occasional forms are met with in which there is an evident tendency toward twin development, as shown by one-half remaining shaded between crossed nicols while the other is light, or as in Fig. 9, where the entire left of the field, the barred portion, shows like orientation, while the smaller granules to the extreme right are crystallographically independent. In these grate-like or barred forms the bars at times extend entirely across the face of the chondrus, or again show short and interrupted forms, as in Fig. 9 and the chondrus in the upper right of Fig 1. The olivines of the ground-mass are always in the form of fragments, as shown by the colorless areas in Figs. 1 and 2 and also in Figs. 3, 4, and 5. The last three are, I believe, indisputably fragments. Fig. 3 is evidently a portion of a

*Reproduction Artificielle de divers types de Meteorites, par MM. F. Fuquè and A Michael Lèvy. Bull. Soc. Min. de France, Vol. IV, 1881, p. 279.

† Mik. Beschaffenheit der Meteoriten.

‡ Neues Jahrb. fur min., etc., Beil Band IV, 1885 (1886), p. 473.

barred form somewhat resembling Fig. 9. Fig. 4 is a portion of a large, clear, colorless crystal, while in Fig. 5 I have endeavored to show the outlines of a fragment in which the colorless portions represent perfectly clear olivines imperfectly secreted from an amorphous glass base so thoroughly impregnated with dust-like particles as to be of a deep gray or blue-black color.

THE ENSTATITE.—This, like the olivine, occurs both in the form of chondri and as scattered fragments in the groundmass. It is distinguishable from the olivine by its gray color, less transparency, well-developed cleavage parallel to the vertical axis, and by its insolubility in acids. The position of the plane of the optic axes could not be made out with certainty with the instrument at command, but as the mineral is biaxial, non-pleochroic and extinguishes always parallel with the vertical axis, there is apparently no doubt as to its true nature. The chondri are sometimes composed wholly of enstatites with small quantities of interstitial amorphous base, or of olivine and enstatite together.

The distinction between the two minerals is, owing to their small size and imperfect development, often impossible by the microscope alone. A more common form of the enstatite is that of irregular fragments with a radiating or fan-shaped structure, as shown in the upper left portion of Fig. 1, the large lower central area in Fig. 2 and in Fig. 6. Other quite perfectly spherical, very minute forms occur, consisting of an almost wholly amorphous material or with only faint beginnings of crystallization shown by rays of light radiating across the surface as the stage is revolved. The exact mineralogical nature of these can not be determined.

THE METALLIC IRON occurs in lumps, as shown in Figs. 1 and 2, and in very irregularly-outlined areas, as in Fig. 10, or as injected drops in the interior of the chondri. It is of a silvery white color by reflected light, and readily distinguished from the pyrrhotite with which it is nearly always associated, and which shows a bronze-yellow luster. In a few instances grains or chondri of olivine or enstatite are entirely surrounded by a dark border of iron and pyrrhotite, as Tschermak* has figured from sections of the Cabarras meteorite. In such cases the iron often penetrates slightly into the mass of the mineral, having evidently exercised a corrosive action.

THE GROUNDMASS.—The structural features of the groundmass are, as already observed, very obscure. It consists of minute angular particles of olivine and enstatite imbedded in a matrix so fine and so badly stained by iron oxides that its true nature can not be satisfactorily ascertained. From the fact that this coloring matter has become so thoroughly disseminated throughout the whole mass, I am inclined to regard it as tufaceous. A wholly granular, glassy, or partially devitrified base would seemingly have proven less pervious and shown the ferruginous staining only along lines of fracture and cleavage. Nevertheless,

* *Op. cit.*, Plate XIX, Fig. 3.

in order to avoid being guilty of any intentional exaggeration, I have merely indicated these obscure portions by the finely dotted areas in Figs. 1 and 2.

The chemical investigation of the stone was rendered somewhat unsatisfactory owing to the badly oxidized condition of the metallic portions. For the results given below I am indebted to Mr. J. E. Whitfield, of the U. S. Geological Survey.

The complete analysis gave:

	Per cent.
Metallic portion	6.21
Soluble in hydrochloric acid	52.19
Insoluble in hydrochloric acid	41.60
	100.00
Specific gravity	3.57

The metallic portion yielded:

	Per cent.
Fe	88.25
Ni	11.27
Co	.48
	100.00

The soluble portion is presumably all olivine together with pyrrhotite and secondary iron oxides. An analysis of this portion was rendered of no value from the fact that the first attempt at a complete separation of the two silicate minerals by digestion in dilute hydrochloric acid was a failure, and the badly weathered condition of the stone rendered a second attempt scarcely worth the while. The insoluble portion was separated by prolonged digestion in dilute hydrochloric acid, followed by boiling sodic carbonate. The remaining powder showed under the microscope very pure enstatite fragments, together with rarely a minute grayish particle that acted but faintly on polarized light and the exact mineralogical nature of which could not be ascertained. Mr. Whitfield's results on this powder were as follows:

		Ratio of equivalents.	
SiO_2	54.42		.91
FeO	14.03	.19	.95
CaO	2.46	.04	
MgO	29.11	.72	
	100.02		

This, it will be observed, is a highly ferriferous enstatite (bronzite), with perhaps a small admixture of a lime-bearing pyroxenic mineral, as indicated by the microscope. The relative proportions of the various

constituents, as they existed in the fresh rock, can not be estimated with any degree of certainty from the figures as above given for the reasons already stated.

The structure of the stone above described is of sufficient interest to merit further attention. As is well known Dr. Forbes, as early as 1872,* taught that in microscopic structure many meteorites resembled terrestrial tuffs; that they were formed of the débris of some previously existing larger mass, of the ruins of some planetary body. The same year Tschermak † described the Gopalpur meteorite as consisting of a white, earthy, tuff-like groundmass, carrying fragments and "kugels" of bronzite, olivine, and other minerals. Such a fragmental structure, he argued, could have been produced by the friction of the constituent particles between themselves, whereby the more brittle became ground to powder, while the more tenacious remained as kugels, the whole being finally gathered into a loose agglomerate. Again, in 1874, ‡ he taught that many meteorites are of a fragmental nature, are made up of minute flakes and splinters and rounded globules. Later, in 1878, the same authority § described the Grosnaja meteorite as a tuff, the chondri showing that the stone had undergone two distinct phases of formation: (1) a breaking up and trituration of the original *olivinfels*, and (2) an elevation of temperature accompanied by reducing vapors. Drasche, ‖ too, in describing the Lancè stone (which, in many respects, is closely identical with the one under consideration, as shown by his figures and description), speaks of it as having a tuff-like groundmass, carrying olivine and bronzite kugels and fragments, and Reusch ¶ in describing the Tysnes stone, speaks of it as a conglomerate made up of conglomerate fragments. He regards the typical chondri as but small rounded fragments and their form due wholly to external cause, not to internal structure. Within the past year Bosscha ** has described the meteorite of Karang-Modjo, or Magetan, Java, as an *agglomerate* of cosmical substances that have become cemented together. From the fact that the iron occurs in part as granules, and in part in the form of a cement, he infers that the stone originated under a variety of conditions of temperature; that it is not the result of a single fusion and crystallization, but that the various chondri originated separately and isolated from one another.

On the other hand, Dr. Wadsworth, who has devoted more attention to the subject than any other American petrographer, and to whom we are indebted for an excellent review of the subject,†† states it as his belief that

* Geol. Magazine, 1872.

† Min. u. Pet. Mittheil, 1872, p. 98.

‡ Sitz. der Kais. Akad. der Wiss. Math. Natur., Cl. LXXI., 1, II, 1875, p. 661.

§ Min. u. Pet. Mittheil., I, 1878, p. 153.

‖ Min. u. Pet. Mittheil., 1875, p. 6.

¶ *Op. Cit.*, p. 473.

** Neues-Jahrb., v, Beil Band, 1877, 1st Heft, p. 126.

†† Lithological studies, p. 106.

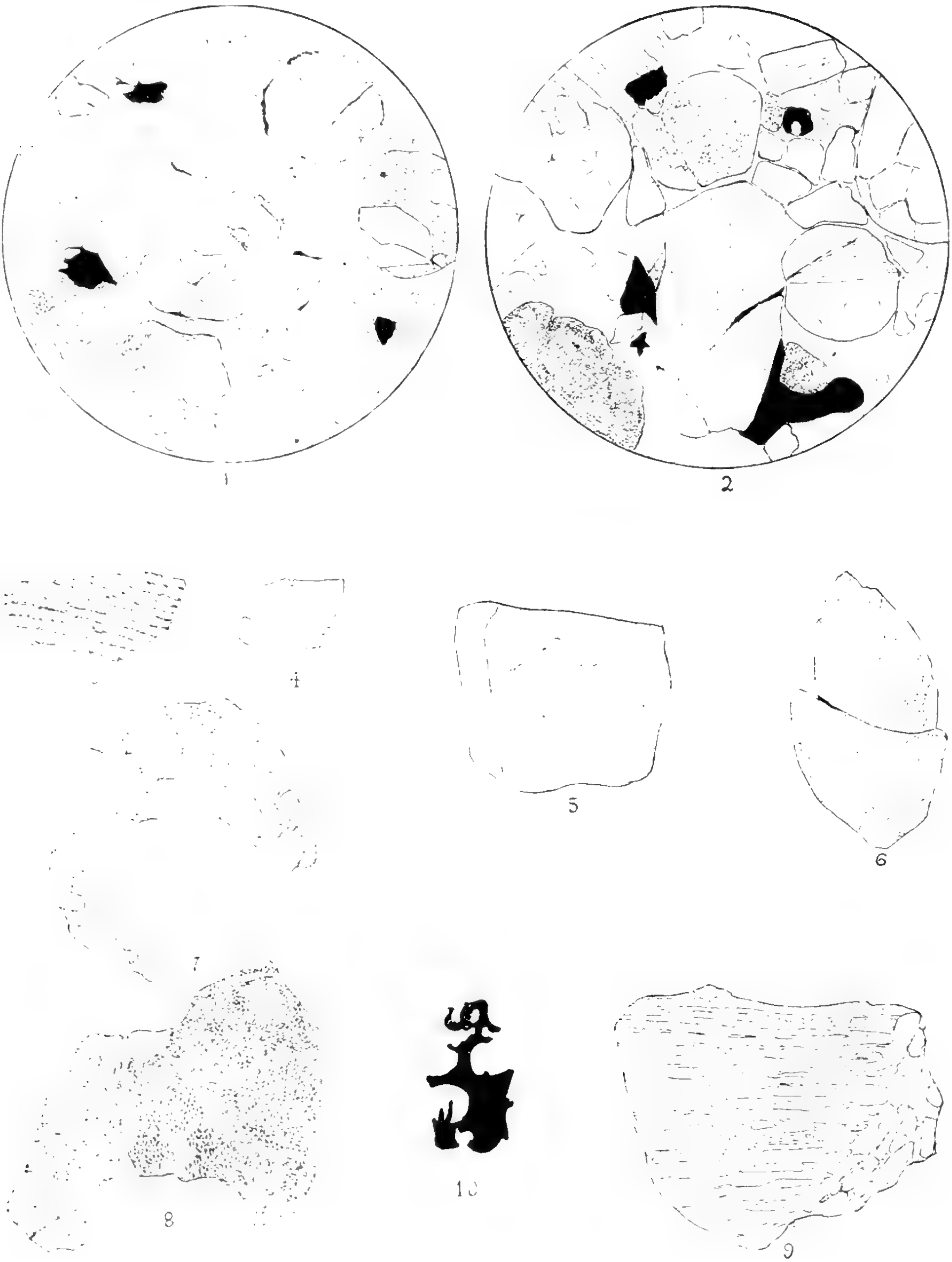
the peculiar fragmental character of meteoric stones is due to "rapid and arrested crystaliization in a molten mass," and further says that so far as examined by him, "they (meteorites) do not appear to be fragmental in the sense of consolidated cold masses joined together. Similar views are, I believe, entertained by Dr. Brezina.* Without pursuing the subject further, and not caring to express an opinion on the subject of the formation of meteorites in general, but confining myself to this particular case, I will say that I can not conceive any possible conditions under which the same minerals could separate out from closely adjacent portions of the same magma under such a variety of forms as shown in the figures, however rapid and interrupted the changes in conditions of crystallization. There are no evidences to indicate that after the first period of solidification and crystallization was brought to a close by cooling there was a second rise in temperature sufficient to allow certain of the silicate constituents to take on more perfect forms. On the contrary, the outlines of the fragments are sharp and angular as those of any breccia. The stone is, I believe, fragmental in the sense of consolidated cold masses joined together. The apparent fragmental nature is, of course, exaggerated by the weathering it has undergone and the consequent shattering of many of the included crystals. It might, indeed, be possible to explain away a part of the obscurities of the ground mass on this supposition; but by no possible stretch of the imagination can I conceive that such forms as displayed in Figs. 2, 3, 4, 6, and 8 can be due to other causes than the breaking up of some pre-existing stone and its subsequent reconsolidation. The peculiarities of structure adverse to this view may, it seems to me, be accounted for, as Tschermak † has done in the case of the Grosnaja meteorite, by supposing that subsequent to the breaking up of the original *olivinfels* there was a second rise in temperature, accompanied by reducing gases and vapors sufficient to alter the molecular structure, but not produce fusion. The peculiar habit of the iron in acting as a cement, whether accounted for, as Nordenskiöld ‡ has done, by supposing that it results from the reduction of an iron-rich silicate or on other grounds, has unmistakably assumed its present form since the consolidation of the stone. Its injection in strings and globules into the mass of certain of the "kugels," or completely enfolding them, is such as might be expected under these conditions. In this connection the suggestion made by Reusch,§ to the effect that the spherical form of the kugels may be due in part to the corrosive action of the molten iron, is worthy of consideration. This same writer ascribes the origin of the peculiar fan-shaped fragments of enstatite to the breaking up into cone-shaped masses and subsequent trituration of radiating enstatite spherules. In

* I have not had access to Dr. Brezina's papers.

† *Op. cit.*, p. 160.

‡ Zeit. der Deutsch. Geol. Gesell., Vol. XXXIII, 1881, p. 25.

§ *Op. cit.*



MICROSTRUCTURE OF SAN EMIGDIO METEORITE.

(Explanation of plate on page 167.)

the process of trituration the sharp points of the conical fragments would be readily broken away and the fragments thus assume the shape shown in the figures.

NATIONAL MUSEUM, *June* 18, 1888.

EXPLANATION OF PLATE XXXV.—SHOWING MICROSTRUCTURE OF THE SAN EMIGDIO METEORITE.

(The outlines as here shown were drawn with the aid of a camera lucida.)

FIG. 1.—Portion of slide 47833-5 magnified fifty diameters. The perfectly black areas are metallic iron; the large, colorless, angular area, with slight radiate structure is enstatite; all the clear portions are olivine. The finely dotted portions represent simply portions so finely pulverulent and stained by iron oxide as to render unsafe any attempt to represent it by a pen drawing.

FIG. 2.—Portion of slide 47833-3 magnified fifty diameters. The black areas are metallic iron; the large radiating angular fragment in the lower center enstatite. All the other clear, partially shaded or finely granular portions are olivine. The rounded form at the right of the enstatite fragment is a monosomatic chondrus; the one just above, polysomatic. The somewhat rounded, elongated, triangular form just above the upper left corner of the enstatite is pyrrhotite. The finely dotted portions as in Fig. 1.

FIGS. 3, 4, and 5.—Fragments of olivines in slide 47833-2. In Fig. 5 the finely dotted portion represents an amorphous dark gray, nearly black, glass, from which has been secreted the olivines shown by the colorless areas. Particles vary from 0.2 to 0.35^{mm} in greatest diameter.

FIG. 6.—Fragment of enstatite in slide 47833-1. Actual size, 0.37^{mm}.

FIG. 7.—Fragment of polysomatic chondrus, consisting of clear, colorless olivines in a partially devitrified base, section 47833-3. Actual size, 0.85^{mm}.

FIG. 8.—Finely granular and porphyritic fragments in section 47833-1. Actual size of largest fragment, 0.60^{mm}.

FIG. 9.—Barred and granular form in section 47833-3. All that portion with the parallel-lying horizontal bars belongs to one crystal. The rounded granular areas at the extreme right are crystallographically independent. The whole forms one fragment. Actual size, 0.59^{mm}.

FIG. 10.—Irregular mass of native iron. The rounded embayments are occupied by olivines and enstatites. Actual size, 0.55^{mm}.

DIAGNOSIS OF THE KAMTSCHATKAN THREE-TOED WOODPECKER (PICOIDES ALBIDIOR).

BY LEONHARD STEJNEGER.

In my "Synopsis of the Birds reported to inhabit Kamtschatka" (Bulletin U. S. Nat. Mus., No. 29, p. 321), I based the name *Picoides albidior* on some remarks by Prof. L. Taczanowski (Bull. Soc. Zool. France, 1882, p. 396). Through the kindness of my friend, the late Capt. E. Hunter, of Petropaulski, specimens of the bird in question have come in my possession. A brief formal diagnosis, therefore, may not be out of place.

Picoides albidior STEJN.

Diagnosis.—Center of back, whole under side, including flanks and crissum, and under wing coverts, pure white, without black stripes or bars; outer rectrices white at tip without black cross-bars.

Dimensions.—Wing, 120^{mm}; tail-feathers, 78^{mm}; exposed culmen, 24^{mm}.

Habitat.—Kamtschatka.

Type.—U. S. Nat. Mus. No. 110,000.

Synonymy:

1858.—*Picus tridactylus* KITTLITZ, Denkw. Reise, I, pp. 327, 329 *nec* (LINN.).—GUILLEMARD, Cruise Marchesa, I, p. 90 (1886).

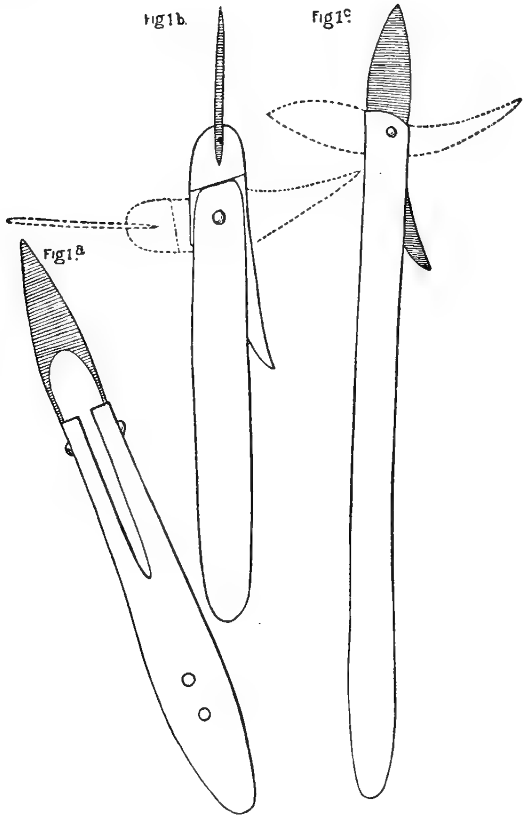
1882.—*Picoides crissoleucos* TACZANOWSKI, Bull. Soc. Zool. France, 1882, p. 396 (*nec* REICHENB.).—DYBOWSKI, Bull. Soc. Zool. France, 1883, p. 368.

1885.—*Picoides albidior* STEJNEGER, Res. Ornith. Expl. Kamtsch., p. 321.—*Id.*, in Guillem, Cruise Marchesa, I, p. 277 (1886).—*Id.*, Mitth. Ornith. Verein Wien, XI, 1887, p. 132.

A REMARKABLE ESKIMO HARPOON FROM EAST GREENLAND.

BY JOHN MURDOCH.

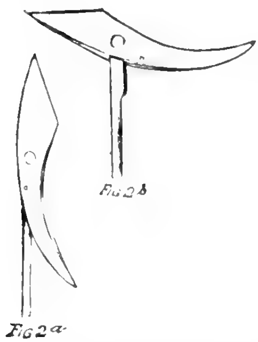
Through the kindness of Dr. H. Rink, of Christiania, the well-known writer on Eskimo ethnology, I have lately received an accurate sketch made by himself of some remarkable harpoons used by the East Greenlanders, and brought home by the Danish expedition of 1884–'85. A brief description of this peculiar weapon in Dr. Rink's paper on the East Greenlanders (*Deutsche Geographische Blätter*, IX, 3, p. 233) first called my attention to the subject, and a letter to the author received the usual prompt and courteous attention that Dr. Rink always gives to such applications.



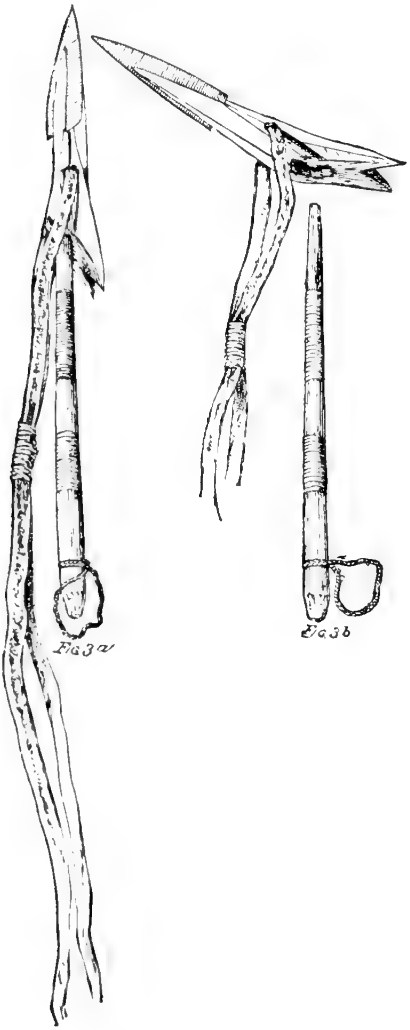
The remarkable thing about the harpoon (Fig. 1)* is that it is an almost exact copy in bone and iron, of the ordinary "toggle-iron" used by civilized whalemen, chiefly, if not exclusively, by Americans. Fig.

* Fig. 1. Harpoons from East Greenland, sketched by Dr. Rink. *a* Front view and *b* side view of one harpoon; *c* side view of another. The dotted lines show the position of the head when "toggled."

2 is drawn from a specimen of the latter in the National Museum.



It will be seen that the only difference in plan of construction between the two weapons is that in the Greenland harpoon the head fits into a cleft in the tip of the shank, where it is secured by a pivot, while in the civilized "iron" it is the shank which fits into a groove in the head. The resemblance is at all events so close that there can be very little doubt that the East Greenland weapon is intended for a copy of the civilized one. The model was probably obtained, as Dr. Rink suggests, from a harpoon found in some wreck, or what is perhaps more likely, cut from the carcass of a whale. It is well known that whales have carried harpoons for a great distance from where they were struck, even, it is said, from Davis Strait to the Arctic north of Bering Strait. It is a strange fact that of all the Eskimo race, most of whom have been long in contact with civilized whalemen, the isolated East Greenlanders, who could have come across the toggle-iron only by accident, should alone have adopted it as a model. The reason the Eskimos elsewhere, however, have not adopted the pivoted toggle harpoon is probably because they are satisfied with their own peculiar type of the weapon. This type is nearly universal among the Eskimos (see Fig. 3 for a sufficiently typical representation), and has the head entirely separated from the shaft, but so slung in a loop at the end of the line that when plunged into an animal it becomes detached from the shaft and "toggles" at right angles to the line, which thus performs the functions of the shank in the other two patterns. The Eskimos, generally, are probably right in adhering to this old pattern which, with its stout line of raw-hide, is probably stronger than the East Greenland harpoon with its slender pivot and comparatively weak shank of bone, which lacks the toughness and flexibility of the high grade of wrought iron used for the equally slender shank of the civilized harpoon.



The East Greenlanders have, however, done a curious thing in copying the civilized harpoon. It is generally stated, and in all probability is true, though I have not been able to learn who first adopted the idea, that the modern American "toggle-iron" was suggested by the usual Eskimo weapon, much as the "Rob Roy" canoe, with its double-bladed paddle, is a civilized modification of the kayak. Thus we have an invention originating among savages, adopted and modified by civilized men, and then taken back with its modifications by savages of the same race as the inventors, who could have had no possible knowledge that it was the old harpoon of their fathers coming back to them in this strange shape.

It is not stated how generally this peculiar pattern of harpoon is used by the East Greenlanders. In view of what I have said of the probable weakness of this type, as compared with the usual Eskimo harpoon or civilized "iron," I should not be surprised to learn that the specimens brought back by Captain Holm were rather unusual even in East Greenland, and had been made as experiments by some particularly enterprising and ingenious native.

SMITHSONIAN INSTITUTION, *December* 5, 1887.

THE CORRUGATION IN AFRICAN SWORD BLADES AND OTHER WEAPONS.

BY WALTER HOUGH.

There is a feature in African iron weapons of nearly all descriptions of a flexure in the median line of swords, knives, assagais, arrows, etc. The horizontal section of a weapon with this characteristic is like a thin letter S, or Hogarth's line of beauty, with a little less curve at the edges than the latter. In some weapons it is a strongly marked ogee corrugation. On each face a portion of the blade is sunk on one side only, and on the other face the depression is on the reverse side.

There has been much conjecture by ethnologists and collectors as to the use of this notable structure. It has been supposed to determine a spiral flight in weapons. As it occurs not only in missile weapons, as arrows and assagais, but also in trenchant weapons, as knives, swords, bills, and short sword-knives of the Congo natives, where the peculiarity is useless, this reason is not valid. It has also been called a "blood groove," and such fanciful stories about its purpose to retain blood of enemies, or to cause a wound made by a weapon to bleed more freely, may be dismissed with scant notice. Burton, in his exhaustive work "The Sword" (p. 170), calls attention to the remark by Col. A. Lane Fox on the African corrugated sword in Anthrop. Coll., p. 135, but makes no explanation of it. He makes, however, the interesting remark that this peculiarity is persistent in all the swords obtained from the Caucasus, and that the iron blades of Saxon and Frankish spears found in graves in England and France possess it.

In examining a short or half sword brought by Lieut. E. H. Taunt, U. S. Navy, from the recently explored country of the Bakoubas, on the Kassai River, Africa, I was led to believe that the semi-fold in the blade was only a very effective way of making a thin, soft-iron blade rigid on the principle of the hollow column.

The sword spoken of (Catalogue No. 129,929) has a leaf-shaped blade, only 12 inches long, while it is nearly 8 inches wide. The blade, a very superior piece of blacksmithing, is like thin sheet-iron, yet it is made very strong and unyielding by this device.

I think that wherever blades of thin, soft iron are to be made we will find this ogee fold, as in the backs of scythes, etc. The bronze scythes, sickles, and some knives of the Lake Dwellers were strengthened in that way as in ours, and the spears of the Franks and Saxons required it too, because they were of soft iron. From what we have seen this is an invention of no mean antiquity, and it is held that the reason assigned is a *vera causa* in the matter under consideration.

U. S. NATIONAL MUSEUM, *October* 30, 1888.

NOTES ON THE OSTEOLOGY OF THE THRUSHES, MIMINÆ, AND WRENS.

BY FREDERIC A. LUCAS.

(With Plate XXXVII.)

The present paper was commenced more than a year ago, but many circumstances have combined to prevent its completion sooner. It was undertaken at the suggestion of Mr. Robert Ridgway, in the hope of throwing a little light on the relations of the *Miminæ*. This peculiarly American subfamily, formerly placed among the Thrushes, has of late found a resting-place with the Wrens, and in the A. O. U. Check List stands at the foot of the family *Troglodytidæ*, *Galeoscoptes* standing last of all. I must at the outset confess that it has been a somewhat difficult matter to select for comparative purposes characters that should be at once well marked and of undeniable taxonomic value. Judging from an examination of many specimens such characters would seem to be found in the shape of the maxillo-palatines, pars plana, costal process, and coracoid. Many bones which might be supposed to offer good points are found untrustworthy when put to the test.

Looking down upon two parallel series of Crania, one of Thrushes and one of Wrens, the first will be found to differ from the second in the much greater breadth of the lachrymal region due to the lateral expansion of the pars plana.

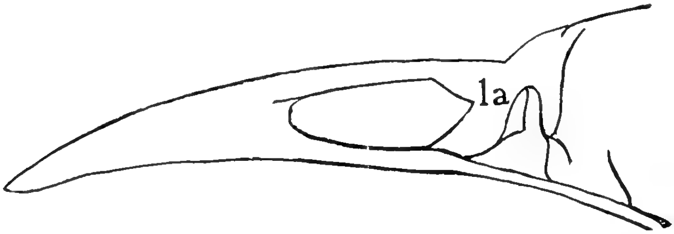
Viewed in the same way the skulls of the *Miminæ* are seen to be intermediate between the two, although the *Miminæ* vary somewhat among themselves; *Harporhynchus*, due allowance being made for its size, having as narrow a skull as the Wrens, while *Galeoscoptes* and *Melanoptila* approach, but do not equal, the Thrushes.

Another very obvious character for comparative purposes is found in the relative width of the external process of the nasal and the angle subtended by this bone and the pars plana. In all the Thrushes examined the external process of the nasal is broad, in all the Wrens and in the *Miminæ* it is narrow. In the Thrushes the angle formed by the nasal and pars plana is very acute, while in the Wrens and Mocking-Thrushes the corresponding angle is more or less open, most so in the Wrens. In these particulars *Galeoscoptes* comes nearer the Thrushes than do its associates.

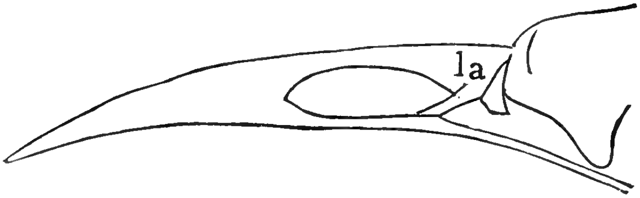
Aside from the small taxonomic value of the lachrymal it is a most unsatisfactory bone to deal with, not only from its small size but from its delicate texture and the insensible manner in which it merges into the surrounding membrane. This causes the lachrymal to be frequently lost in the preparation of a skull, in spite of the most watchful care, and

doubtless accounts for the absence of this bone in many of the skulls herein noted.

In *Merula aurantia* and *Turdus mustelinus* the lachrymal has the form and articulation shown in the accompanying figure:



Lachrymal region of *Merula aurantia*.



Lachrymal region of *Campylorhynchus affinis*.

Lachrymal region of *Harporhynchus curvirostris*.

The lachrymal of *Harporhynchus* is also better described by the figure than it could possibly be in words. In *Mimus* this little bone is triangular in shape, as in some Wrens, but instead of being wedged in between the pars plana and the nasal, as in those birds, it is attached solely to the nasal. This is also the case with *Galeoscoptes*, and in this respect these two *Miminæ* resemble *Merula aurantia*.

Campylorhynchus affinis and *Salpinctes obsoletus* have a sharp-pointed lachrymal, driven well home between the pars plana and nasal. A most careful examination of *Thyromanes felix* has failed to discover any trace of the lachrymal whatever. Seen from below the greater size of the pars plana in the Thrushes than in the Wrens or *Miminæ* is very apparent. Among the *Miminæ*, *Galeoscoptes* and *Melanoptila* most nearly approach the Thrushes in the size of the pars plana, while between them and the Wrens come *Harporhynchus* and *Mimus*. The prepalatines are slightly wider in the Thrushes than in the *Miminæ* or Wrens, and the transpalatine process is usually blunter in the Thrushes than in the other birds under consideration.

This character can, however, be of but little value, since the process varies in shape even among species very nearly related. *Mimus bahamensis*, for example, differs from its near relations in having a blunt transpalatine very much like *Turdus mustelinus*.

The Wrens, however, agree among themselves in possessing a transpalatine process terminating in a sharp point of the pattern indicated in Plate XXXVII, fig. 1.

Passing to the maxillo-palatines we find these little processes to have the same shape in *Mimus*, *Mimodes*, *Harporhynchus*, *Melanoptila*, and *Oreoscoptes*. This last-named bird I have not examined, but Dr. Shufeldt's description agrees exactly with that of the corresponding process in the other species above mentioned.*

Galeoscoptes differs from the other *Miminæ* in the shape of the maxillo-palatines, which conform very nearly in pattern to those of the Thrushes, who agree among themselves in having the maxillo-palatines of the shape shown in Plate XXXVII, Fig. 3.

The Wrens have a very characteristic, slender, and sharply-pointed maxillo-palatine, the shape of which can best be understood by a reference to Plate XXXVII, Fig. 1.

In spite of the fact that *Galeoscoptes* does not agree with the other *Miminæ* in the shape of its maxillo-palatines I am inclined to place considerable taxonomic value on this process for the distinguishing of nearly related forms, especially when correlated with other characters.

This surmise should, however, be tested by the examination of a large series of specimens, but in addition to the species noted in this paper I have found that our six species of Swallows have each and all the same shaped maxillo-palatine, while *Micropus apus*, *M. melanoleucus*, *M. subfurcatus*, *Chætura pelasgia*, *Collocalia fuciphaga*, and *Dendrochelidon mystacea* also have their own characteristic-maxillo-palatine.

The anterior extremity of the vomer is subject to great specific variation of form, and I have been unable to find that it has, if any, more than an extremely slight taxonomic value.

The shape of the tympanic fossa is even more variable, but the temporal fossa seems to present more tangible characters.

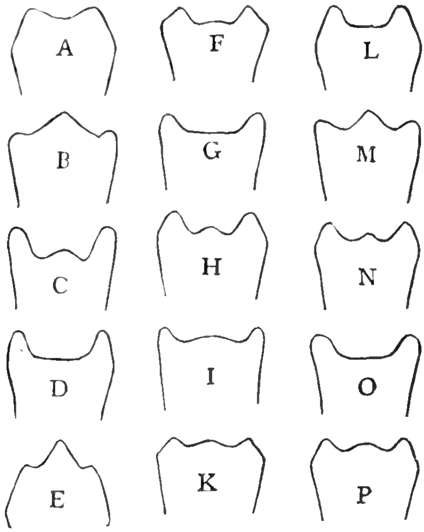
Thus in the Thrushes this fossa is so deep and produced so far backward as to make a very noticeable notch in the contour of the skull when viewed from behind. This notch was least marked in *Turdus musicus*, possibly from the fact that the specimen examined had been a cage bird. In the *Miminæ*, and also in the Wrens, the temporal fossa is shallow and not produced backward, thus breaking in but little on the transverse outline of the cranium.

The form of the scapula is so extremely variable that it can furnish at the best specific characters only. As a rule it is more decurved and

* Since this was written Dr. Shufeldt has kindly sent me two specimens of *Oreoscoptes*, which show that the maxillo-palatines have the same shape as those of *Mimus*, etc.

expanded toward the tip in the Wrens than among the Thrushes, yet *Merula aurantia* is in this particular very Wren-like.

Harporhynchus, *Galeoscoptes* and *Melanoptila* have each a graceful scimetar-shaped scapula, *Mimodes* has a rather straight "blade-bone" while *Mimus* has a blunt-tipped scapula.



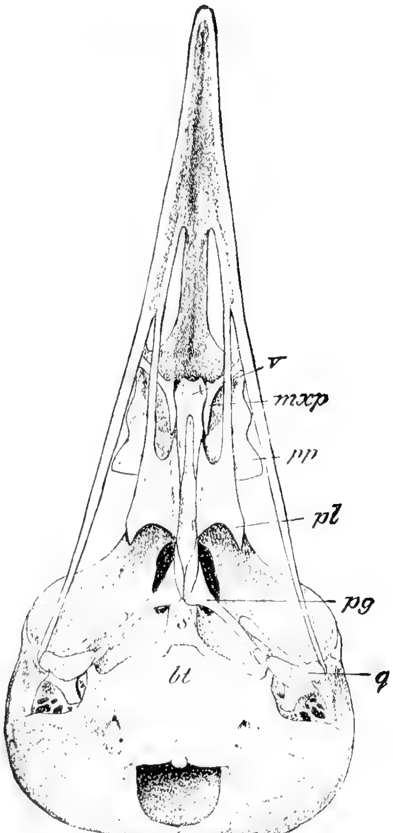
Figures of Vomers.

A.—*Campylorhynchus affinis.*
B.—*Salpinctes obsoletus.*
C.—*Thyromanes felix.*
D.—*Troglodytes aëdon parkmani.*
E.—*Telmatodytes palustris.*
F.—*Mimus bahamensis.*
G.—*Galeoscoptes carolinensis.*
H.—*Harporhynchus curvirostris.*
I.—*Mimodes graysoni.*
K.—*Melanoptila glabrirostus.*
L.—*Turdus mustelinus.*
M.—*Turdus fuscescens.*
N—*Turdus swainsoni.*
O.—*Merula migratoria.*
P.—*Turdus musicus.*

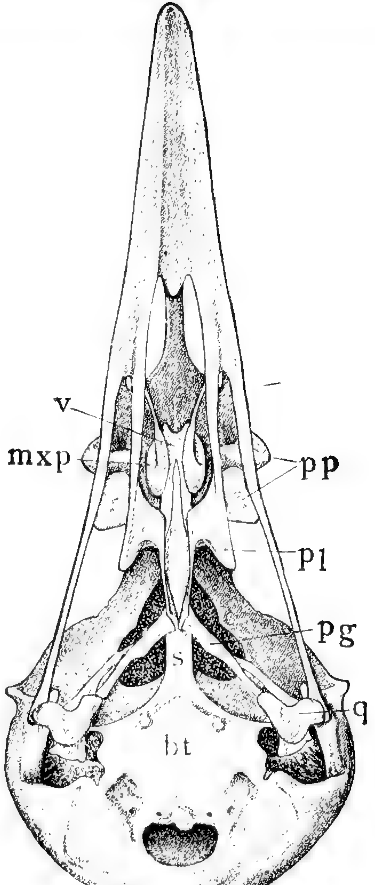
The shaft of the coracoid has the same slender, gracefully curved form in all the birds examined, but the extent to which the epicoracoidal portion is developed varies, seemingly having a distinctive form in each of the groups under consideration.

In the Wrens a narrow buttress of bone is carried from the epicoracoid a short distance along the outer edge of the coracoid. In the *Miminæ* the width of this buttress is increased, while in the Thrushes it widens into a broad but thin wall of bone running half way or more up the coracoid. *Galeoscoptes* is an exception to the other *Miminæ* from the fact that it has the wide coracoidal buttress of a Thrush, while on the other hand *Melanoptila* has the narrow flange of a Wren.

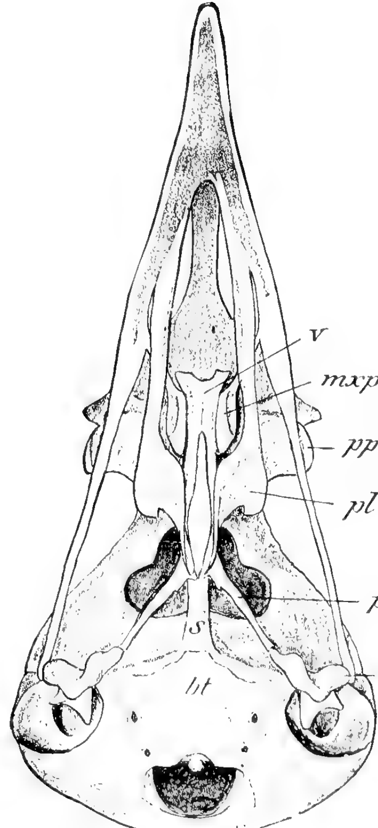
The shape of the costal process of the sternum seems to be a fairly good character for comparative purposes, being one that shows little, if any, specific variation. Taken by itself the shape of the costal process would be of comparatively little value, but taken in connection with



1



2



3

OSTEOLOGY OF THRUSHES, MIMINÆ, AND WRENS. (Page 173.)

1. *Campylorhynchus affinis.* 2. *Harporhynchus curvirostris.* 3. *Merula migratoria.*

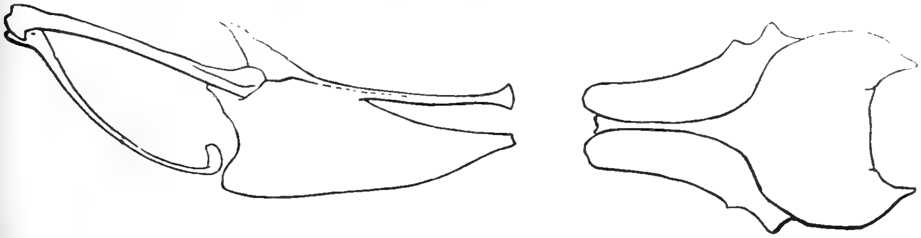
(*v*, vomer; *mxp*, maxillo palatine; *pp*, pars plana; *pl*, palatine; *pg*, pterygoid; *q*, quadrate; *s*, sphenoidal rostrum; *bt*, basi-temporal.)

other characters it becomes important, as it is by certain combinations of characters, rather than by the presence or absence of any one or two, that groups of birds must be divided one from another.

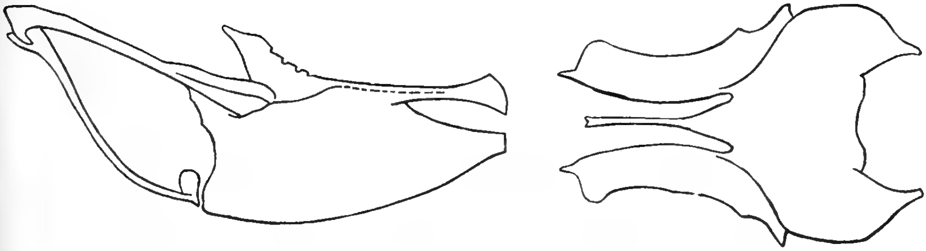
In the Wrens the costal process is slender and so acuminate as to be almost of needle-like sharpness, while in the Thrushes it is large, blunt, and roughly rhomboidal in shape, although varying slightly in different species.

Turdus mustelinus has the largest costal process among the Thrushes, not being equaled in this respect by *T. swainsoni* or *T. fuscescens*. The *Miminæ* are intermediate as regards the shape and size of the costal process between the Thrushes and Wrens.

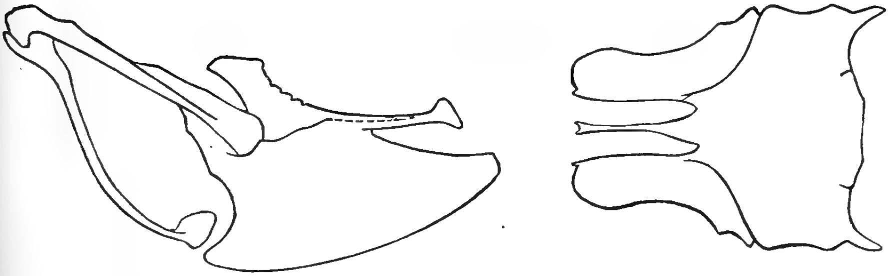
The Wrens have the manubrium a little less deeply cleft than the members of the two other groups under consideration, while the notches in the posterior margin of the sternum are deeper.



Sternum and pelvis of *Campylorhynchus affinis.*



Sternum and pelvis of *Harporhynchus curvirostris.*



Sternum and pelvis of *Merula migratoria.*

The sternum is viewed obliquely in order to better show the costal process.

March 12, 1889.

The pelvis is subject to considerable specific variation, although offering some fairly good points for comparative purposes. In general terms the pelvis in the Thrushes may be said to be short and wide, the width especially noticeable when the pelvis is viewed from behind.

The ilia are short, anteriorly wide, with their transverse axes but little inclined from the horizontal.

In the Wrens the pelvis has a slightly compressed appearance, this being due to the fact that the ilia are rather elongate and narrow, with their transverse axes inclined at a considerable angle from the horizontal. To use a familar simile the ilia of the Thrushes form a rather flat roof, the backbone representing the ridgepole, while the ilia of the Wrens form a roof having a great deal of pitch to it. In the shape of the ilia and general appearance of the pelvis the *Miminæ* are thoroughly Wren-like. The posterior iliac border exhibits great variety of shape, and while *Merula migratoria*, *Harporhynchus curvirostris* and *Salpinctes obsoletus* have what may perhaps be called the typical patterns of their respective groups, yet no one pattern is quite constant.

The posterior iliac border of *Turdus musicus* and *T. mustelinus* bears more resemblance to that of *Harporhynchus* than to that of either *Merula migratoria* or *M. aurantia*. *Mimus* fits in very nicely between *Galeoscoptes* and *Turdus mustelinus*. *Thyromanes* is not very dissimilar to *T. mustelinus*, and *Melanoptila* is in this particular even more like *T. mustelinus*. The ilio-neural groove is open in all the birds under consideration with the exception of *Campylorhynchus* in which the ilia touch and become anchylosed with the spinous processes. This character, if it can be called one, is greatly affected by age, and its taxonomic value is even more than doubtful.

The last two pre-sacrals are shorter, and their transverse processes consequently nearer together in the Thrushes than in the *Miminæ* or Wrens, this difference being very perceptible when the *Miminæ* and Thrushes are compared with one another. In the Thrushes there is a very noticeable ridge or keel along the under side of those pre-sacrals which are fused with the "sacral mass," a feature that is either very slightly marked or altogether wanting in the *Miminæ* and Wrens.

The distinctive characters of the groups thus briefly dwelt upon may be summed up as follows:

Wrens.—Ante-orbital region narrow. Descending process of nasal slender. Angle formed by this process and "pars plana" rather open. Maxillo-palatines acuminate posteriorly. Costal process of sternum small, acuminate. Coracoid with a short flange on the epicoracoidal portion. Pelvis anteriorly narrow, with the ilia much inclined from the horizontal.

Miminæ.—Ante-orbital region narrow. Descending process of nasal narrow. Angle subtended by this process and "pars plana" rather acute. Maxillo-palatines claviform (except *Galeoscoptes*). Costal process moderate in size, somewhat acuminate. Coracoid with a moderate

flange on epicoracoidal portion; pelvis rather compressed, with ilia inclined from the horizontal.

Thrushes.—Ante-orbital region wide. Descending process of nasal wide. Angle formed by this process and "pars plana" acute. Maxillo-palatines of a modified claviform shape. (See Plate XXXVII, Fig. 3.) Costal process of sternum large, blunt, rhomboided in outline. Coracoid with a wide flange running half way up the shaft. Pelvis broad, flattened.

From these brief notes it will be seen that the *Miminæ* hold a somewhat intermediate position between the Wrens and Thrushes, and if the characters described are of sufficient value to be considered *family* characters (which is extremely doubtful) each of the groups under consideration seems to have equal rights in that respect.

The Wrens, as represented by the species in hand, form a harmonious group, agreeing very closely with one another in their osteology, and presenting some well-marked distinctive characters.

The Thrushes also, when compared with the Wrens, present well-defined characters, and while differing among themselves more than do the Wrens, these differences are nevertheless very slight.

Aside from *Galeoscoptes* the *Miminæ* are fairly well marked, having a very characteristic shape to the maxillo palatine process. This maxillo-palatine is so entirely different from that of the Wrens that from what little experience I have had I should hesitate to unite two groups so dissimilar in this respect. On the other hand, *Galeoscoptes* has such decided leanings toward the Thrushes, not only in its skull, but in other portions of the skeleton, that it would seem to connect them with the *Miminæ*. Be this as it may, *Galeoscoptes* is certainly nearer to the Thrushes than any other member of its group, while *Harporhynchus* seems to be the farthest removed.

Since the foregoing pages were written I have, by the kindness of Dr. Edgar A. Mearns, U. S. Army, received specimens of *Oreoscoptes montanus* and the rare *Harporhynchus crissalis*.

Oreoscoptes follows naturally after *Galeoscoptes*, but has the Mimine maxillo-palatine unmodified. *Harporhynchus crissalis* is interesting from the fact that its pelvis very much resembles that of *Campylorhynchus*, being much contracted anteriorly. It is in this respect quite different from *H. curvirostris*. *H. crissalis* appears to be specially modified for a terrestrial mode of life. The wings and shoulder girdle are quite feeble, the wing being of the same length as that of *Oreoscoptes*, while the sternum is not so deeply keeled. The narrowness and rugosity of the pelvis, together with the robust character of the leg bones, indicates good running powers. The hypapophyses of the last cervicals and anterior three dorsals are unusually well developed.

It was intended that *Chamæa* should have been included in this paper, but at the time no specimen was available. While this paper has been

in the hands of the printer, however, there has been opportunity for the accumulation and study of more material, and among other species has been *Chamæa*. As Dr. Shufeldt has been collecting material with the view of making a special study of this form, I will simply say that Chamæa appears most decidedly to belong with the Wrens and not with the Titmice.

Certhia also, judged from its osteology, should be placed with the Wrens, while on the other hand it seems more and more clear that the *Miminæ* should not be included in the very sharply-defined family *Troglodytidæ*.

AN ESKIMO STRIKE-A-LIGHT FROM CAPE BATHURST.

BY WALTER HOUGH.

The natives of the Straits of Magellan and the Eskimo of Cape Bathurst are among the very few races that procure fire by means of flint, pyrites, and tinder. The use of the fire-drill is almost universal; it is so with the flint and steel; but rare are the instances of the more primitive invention, the pyrites or fire-stone, instead of the steel.

Capt. E. P. Herendeen collected at Cape Bathurst, north latitude 70° 40′, longitude 127° 30′, a very rarely-visited locality and the limits of the western Eskimo, a nice lot of fur clothing. In the consignment was an Eskimo fire-bag, that is, a pouch containing the implements necessary to get a spark to light a pipe or a fire. The essential parts

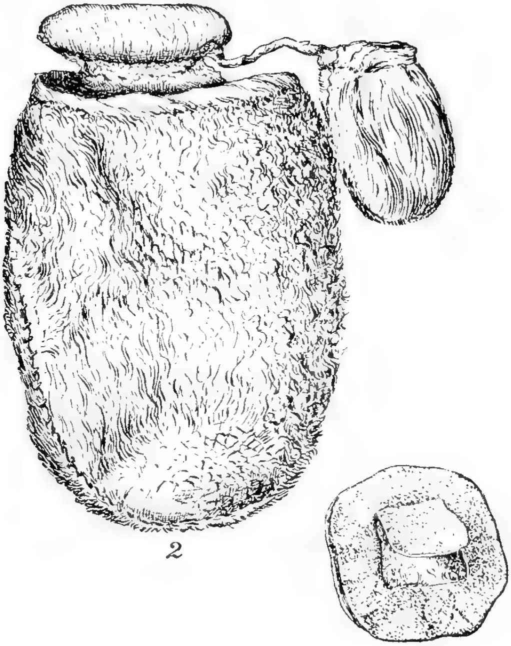
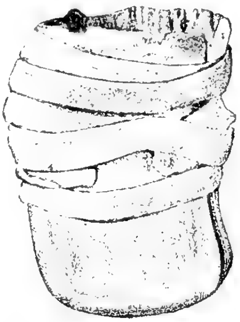


FIG. 1. Tinder pocket. FIG. 2. Fire bag.

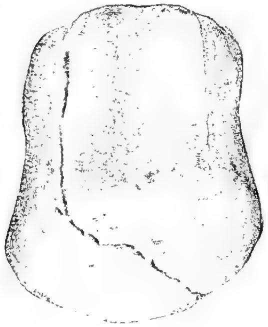
are a piece of pyrites, a piece of flint, and tinder. The latter is made of the seed-down of an arctic plant, or frequently of willow catkins. It is prepared by carefully picking it and then soaking it in a strong solution of gunpowder in water to make it "quick," though this procedure is an innovation. The natives on the Putnam or Kuwũk River, in the region explored lately by Lieut. George M. Stoney, U. S. Navy, mix powdered charcoal with their willow catkin tinder, as do the natives at Point

Barrow.* It is then put into a little, round, flat pouch, with a flap in the middle of one side (Fig. 1). The pyrites (Fig. 3) looks like a short pestle, into which shape it has been worn by the repeated scrapings it has received. The upper end has a natural concavity, while the lower end is as smooth as though it had been used for trituration.

4a



4



3

FIG. 3. Pyrites. FIGS. 4 4*a*. Flint striker and handle.

The flint (Fig. 4) is an oblong piece, square at one end and rounded at the other. It is well chipped and was evidently made for this purpose, though away from its surroundings as used it would be provisionally classed as a scraper, though not a skin-scraper blade, as it is chipped on both sides. Dr. J. Simpson, in the Arctic Blue Book, says that flints are brought from the Kuwŭk River. Mr. Murdoch tells me that the Eskimo think that pyrites comes down from heaven in meteors, and for this reason they call it fire-stone. Two pieces of the latter are often used for striking fire. A native told Mr. Murdoch that in old times they did not use flint, but two pieces of pyrites, and got "big fire." The pieces of flint used at Point Barrow are small and are not fixed in a handle. The flint under consideration is mounted in a short wooden handle (Fig. 4*a*), of two pieces, rudely dressed down with a flint tool, as may be seen from the character of the cutting, which is striated, as though done with a serrated edge. This is corroborative evidence to that of Captain Herendeen, who says that this is a genuine relic of the times before the use of the steel was known to the natives, which has not

* Report of the Expedition to Point Barrow, Alaska, Lieut. P. H. Ray, U. S. Army, p. 46.

been long on the extreme arctic coast whence this specimen comes. The bag (Fig. 2) is made of the scrotum of the reindeer. The little bag which hangs attached to the larger has a double use: it is a receptacle for tinder, but its chief use is as a toggle; being passed under the belt it prevents the loss of the outfit, which is carried by the women.

An oblong pad stuffed with deer hair is sewed to the mouth of the fire-bag to protect the hand from sparks and blows of the flint.

FIG. 5. Using the strike-a-light.

To get a spark the Eskimo places the piece of pyrites on the pad held in the left hand over the curved forefinger (Fig. 5); it is placed large end down and the thumb set in the cup cavity in the top. The flap of the tinder pocket is turned back and held on the forefinger under the protecting pad. The flint is held in the right hand and by a scraping motion little pieces of pyrites at a dull red heat fall down into the tinder. The pellet that glows is transferred to the pipe or fire, and the flap of the tinder pocket is turned down, serving to keep the tinder dry and to extinguish it if necessary.

It is a rare and complete fire-making set, and in the minutiæ and number of accessories shows true Eskimo elaboration, though in detail rudely made. Professor Mason remarks on Eskimo ingenuity that the Australians and Puru-Puru were satisfied with the simplest form of throwing-stick, while the Eskimo have invented a dozen different species with numerous co-ordinating attachments on the spear.* This is also a good example of independence of invention by the Fuegians, and the hyperboreans. The former could use no other means, in that supersaturated atmosphere it is impossible to get a spark by means of a drill.† At Cape Bathurst the cause of the abandonment of the fire drill

*"Resemblances in Arts Widely Separated." American Naturalist, Mar. 1886, p. 251.

†Peschel "The Races of Men," p. 148, cites W. P. Snow's "Off Tierra del Fuego," II, p. 360.

was the extreme difficulty and tediousness of getting fire in that way. The Museum is in possession of a specimen of flint and pyrites from Fort Simpson, a station on the Upper Mackenzie River. It was collected from the Indians by R. B. Ross many years ago.* Another outfit, consisting of a bag with pyrites and bark tinder, was collected in Alaska by John J. McLean, and is presumably Indian.† It is possible that these throw some light on the Indian origin of some of the Eskimo arts, a matter not unlikely to happen, as it is of common observation that the Eskimo is adaptive and it is quite to be expected that there would be reciprocal borrowing of useful arts by neighboring tribes.

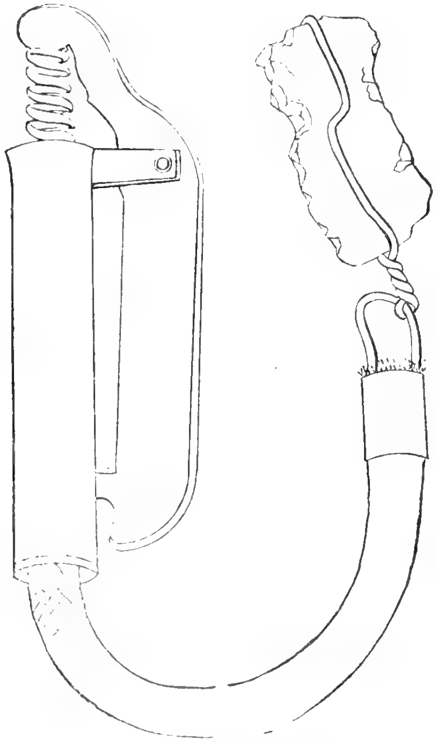


FIG. 6. French "Strike-a-light."

The cigar lighter (Fig. 6), called a strike-a-light, purchased in Paris by Mr. Thomas Wilson, is introduced here to show the survival of a primitive custom. The inhabitant of the avenue de l'Opera, in the "capital of civilization," and he of the shores of the frozen ocean touch. One of the chief qualities of civilization is its adaptiveness, and there is no device of savage man which civilized man can not appropriate and mold to his own use; but the remains of old usages and arts stick to him and come down if not in ethnical sequence yet in direct course from the man acquainted with the use and properties of flint, for instance in the valley of the Somme.

Museum No. 128,405. Fire-making outfit, Cape Bathurst, E. P. Herendeen.

* No. 1,861. Fire-making outfit, Fort Simpson, British America, R. B. Ross.

† No. 60,232. Fire-making outfit, Alaska, J. J. McLean.

NOTES ON CYDOSIA AND CERATHOSIA.

BY JOHN B. SMITH.

Cydosia was first named by Westwood, without any very elaborate characterization, in the thirty-seventh volume of the Naturalist's Library, with *Tinea nobilitella* as sole species and therefore type.

In the second volume of the catalogue Lep. Heterocera in the British Museum, p. 524, Walker describes the genus as follows: "Has some resemblance to Crambus and other pyralites. Body rather stout, not long; palpi short, pubescent; third joint conical, less than half of the second; proboscis short; antennæ slender, testaceous, bare, rather more than half the length of the body; abdomen extending a little beyond the hind wings; legs rather stout; hind tibiæ with four long spurs; wings narrow, rather long; fore wings hardly convex in front, very slightly oblique along the apical border; hind angle slightly rounded; first, second, and third inferior veins very near together at the base; fourth very remote from them."

C. nobilitella Cram. is still the sole species and is credited to the West Indies and various South American points. It forms a part of the assemblage classed by Walker as *Lithosiidæ.*

In 1868 Messrs. Grote and Robinson describe *Cydosia aurivitta* from Texas, and distinguish it from what they identify as *nobilitella* by the lack of determinate white spots, the golden bands alone remaining. The genus is here placed in the family *Zygaenidæ*, subfamily *Zygaeninæ*. Without giving any new characters they refer to its systematic position thus: "The present genus we regard as related to *Apistosia* Hübner, and forming one of a low group of zygaenid genera with simple antennæ and elongate wings, which latter, when at rest, the imago folds after the manner of *Lithosia*. This group is so laden with *Lithosian* analogies as to render its critical study difficult. *C. nobilitella* and *Oeta compta* mimic the Lithosian genus *Utetheisa*. *Deiopeia aurea* Fitch is probably a species of *Cydosia*. * * * Their metallic colors aid our conception of their true position." Messrs. Grote and Robinson here use the term "analogy" as Dr. Packard did in treating of *Ctenucha*, and they regard all the Lithosian features as coming under it and not as affinities. They fail, however, to give any zygaenid affinities save of color and wing form.

In view of subsequent developments it may be as well to note here that *Apistosia* Hb. is placed by its author among the *Lithosiidæ*, and *nobilitella* is referred to the genus *Crameria* and placed directly after *Utetheisa*, a point which has been overlooked, but which speaks well for Hübner's shrewdness in associating allied forms.

Mr. Stretch, in the Zygaenidæ and Bombycidæ of North America, p. 161, writes: "ZYGAENIDÆ—ZYGAENINÆ—Genus *Cydosia*." He gives a somewhat general description of the venation of primaries, but says nothing of the secondaries, the venation of which is so important in fixing the true position of these forms. He follows Grote and Robinson in their comments on its *Lithosiid* analogies, and also remarks on its resemblance to the *Tineidæ*. The species he leaves as they were, but suggests that the species identified as *nobilitella* by Grote and Robinson is not Cramer's species, but an allied one, for which he proposes the term *imitella*, should his suggestion prove correct. No differences are given, as Mr. Stretch, not having access to Cramer's works, could not with certainty identify his species. In 1873 Mr. Grote, in Bull. Buff. Soc. N. Sci., vol. 1, catalogues the *Zygaenidæ* of North America, including *Cydosia* therewith. He, however, makes it the type of a new subfamily, which he calls *Cydosiinæ*, containing this genus only. No characters are given, and no reasons for this separation. He accepts Mr. Stretch's view that the Texan form is not the same as Cramer's species from South America and the West Indies, but now suggests that the two species, *aurivitta* and *imitella*, are merely forms of one variable species.

Nothing is here added to our knowledge of the structure of the species.

In the list of 1882 Mr. Grote retains the same classification, and makes *imitella* Str. a variety of *aurivitta* G. & R. *Penthetria* Hy. Edwards is added to the *Cydosiinæ* without comment or question.

Recently Mr. Edwards removes his genus to the *Hetergynidæ*, quite erroneously in my opinion, though he was undoubtedly correct in breaking up the association with *Cydosia*.

In preparing my notes on the so-called Zygaenid genera, published in Trans. Am. Ent. Soc., 1885, vol. 12, pp. 77–84, I had no specimen of *Cydosia* at hand for study, and I simply referred to it as of uncertain location.

In the Stettiner Ent. Zeitung, 1885, vol. 46, pp. 203–208, Mr. H. B. Moeschler reviews my paper, and fully agrees with my disposition of the majority of the genera. Of *Cydosia*, which he appears to know well, he says it is unquestionably *Lithosiid*.

Recently, in a little lot of odds and ends shown me, I found a fragmentary, rubbed specimen of *C. aurivitta* and took the opportunity of glancing at the venation. I saw at once that the venation was, as Moeschler suggests, *Lithosiid*. This induced me to examine the Museum collection, which contains a considerable number of both *aurivitta* and *imitella*, and I was easily able to make out the entire venation, which was completely *Lithosiid*. An examination of the head, however, showed a prominent clypeal protuberance and very distinct ocelli, making the genus *Arctiid* and closely allied to *Cerathosia* Smith. From this latter it differs in lacking the claw of the fore tibia and the acces-

sory cell of the primaries, as well as in minor features of venation, wing form, etc.

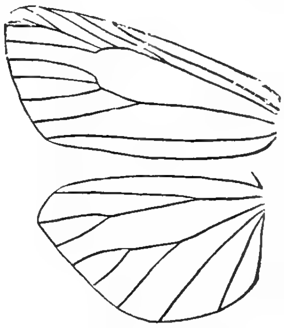
These two genera—*Cydosia* and *Cerathosia*—furnish a very interesting and instructive part of our *Arctiid* fauna, combining as they do the habitus of the *Lithosiidæ* and some of their peculiarities of venation, with the presence of ocelli, leaving the latter as the sole distinctive feature separating the *Arctiidæ* from the *Lithosiidæ*. With the *Zygaenidæ*, *Cydosia* is analogous only in color, the affinities are all *Lithosian*, and Mr. Grote and his followers have allowed themselves to be blinded by this superficial character, which did not even deceive Hübner into overlooking the absolute agreement in all essential details with *Lithosia*.

As *Cydosia* and *Cerathosia* form a distinct group in the *Arctiidæ*, to which the term *Cydosiinæ* may continue to be applied, I will give in detail the characters of the genera and species, premising that the subfamily is distinguished by the narrow primaries, ample secondaries, and the conic protuberance of the clypeus.

Genus **Cydosia** Westw. Dunc. Nat. Libr. 37, 193.

Head distinct, not prominent, the clypeal protuberance roughened in front, not depressed centrally. Palpi minute, not exceeding front, slender. Tongue strong, moderate in length. Antennæ simple in both sexes. Thoracic vestiture scaly, closely appressed. The legs are stout, tibiæ gradually becoming longer posteriorly; the median tibia with one pair, posterior with two pairs of spurs. Abdomen cylindric, stout. The genitalia will prove interesting, but they are small and not easily made out, and I have no material for dissection.

In detail the venation is as follows: Primaries, 12-veined; vein 1 free, not furcate at base; vein 2 from median, about three-fifths from base; veins 3, 4, and 5 nearly equidistant from the end of the median vein; vein 6 from the extreme end of the subcostal; veins 7, 8, and 9 on one stalk, 9 nearest to base, 7 and 8 forking very close to the apex; vein 10 from subcostal, as far from 7 as the latter is from 6; vein 11 from subcostal, three-fourths from base, free to costa; vein 12, the costal vein, from base, free, parallel to costa, which it joins three-fifths from base.



Venation of Cydosia.

Secondaries lacking vein 5. Two internal veins as usual; vein 2 from the median, half way to its furcation forming veins 3 and 4; 6 and 7 formed by the furcation of the subcostal; vein 8 from the subcostal about one-third from base.

Mr. Edwards assures me that the Texan form is perfectly identical with the West Indian form which Cramer named *nobilitella*, and this name must therefore be restored and *imitella* Stretch cited as a synonym.

C. nobilitella Cram. Pap. Ex. Pl. 264 f. G., *Tinea;* Hüb. Verz., p. 168, *Crameria;* Westw. Dunc. Nat. Libr. 37, p. 193, *Cydosia;* Wlk. Cat. Brit. Mus. Lep. Het. 2, p. 523, *Cydosia;* Grt. & Rob. Trans. Am. Ent. Soc. II, p. 186, *Cydosia;* Stretch, Zyg. & Bomb., 162, pl. 7, f. 8, *Cydosia.*

imitella Stretch, Zyg. & Bomb., 163 et 242, an sp. dist. præc. Grote Bull. Buff. Soc. N. Sci., I, 36, an var. *aurivitta.*

Var. *aurivitta* Grt. & Rob. Trans. Am. Ent. Soc., 2, 186, pl. 3, f. 68, *Cydosia;* Stretch, Zyg. & Bomb., 163, pl. 7, f. 9, *Cydosia.*

Head, thorax, and abdomen bluish or greenish black, metallic, with white spots arranged as follows: A spot on the vertex; two small dots at base of antennæ; a few white scales on front and palpi; collar nearly all white; patagiæ with two spots each; disk of thorax with five dots. Beneath the legs are maculate with white and numerous whitish hair lighten up the breast. Anal segment of the male ringed with bright fulvous scales.

Primaries bluish or greenish black, metallic; a golden-yellow costal stripe from base to a point over the inception of the first transverse band; a broad, slightly oblique golden transverse band from the median vein down to inner margin, about one-third from base; another still broader transverse band of the same color rather close to and nearly parallel with the outer margin. A subquadrate spot of the same color beyond the middle of the cell, filling the space between the ordinary spots which here are obsolete. Between these prominent deep golden markings are white spots and patches as follows: A dot at base; an elongate spot below the internal vein not reaching the first transverse band; an elongate spot between vein one and the median vein, also not touching the transverse band; a large round spot in the cell, between the basal band and the discal spot; below this a smaller, also round spot; beyond the discal spot are two upright somewhat lunate spots before the outer transverse band, and below these is a large, subquadrate spot near the internal margin. Beyond the outer golden band is a series of white dots beginning with a curved series of three or four small dots on costa, then three larger and somewhat angular spots, the upper much the larger. A white line at base of fringes.

Secondaries immaculate somewhat darker than the primaries.

Beneath, primaries with a series of small apical white dots and white fringes, else black, immaculate: secondaries black, immaculate except as apex where the fringes are white marked.

Expands, .85–.90 inches=21–23^{mm}.

Habitat.—Texas.

The variety *aurivitta* is in every respect identical with the type form save that it completely lacks all the white maculation. Exactly what relation these two forms, which seem so distinct at first appearance, bear to each other is not yet known. They are not sexes, as we have both sexes of each; they seem to copulate readily, as we have ♂ of one and ♀ of the other taken *in coitu.* The variation is not gradual, for I

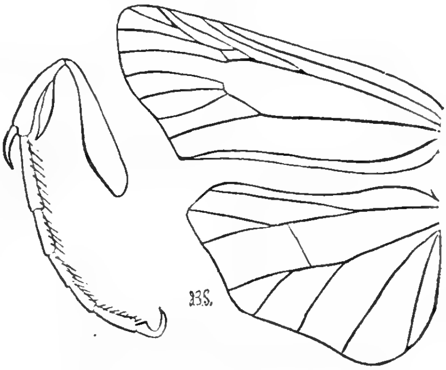
have seen nothing like real intergrades. The larval history, which might serve as a guide, is unknown as yet.

According to Belfrage, as quoted by Stretch, the insects fly in May and June. They are generally distributed through the State of Texas, though nowhere common; are generally taken on the wing in the daytime and are also attracted to light at night.

In the Museum collection we have eighteen specimens, about equally divided between the two forms, and ranging in dates of capture from the middle of March to the end of May. One specimen is dated August, which appears to indicate two broods.

Cerathosia Smith. Entom. Amer., 1887, vol. 3, p. 79.

Body slender, graceful, untufted. Head distinct, rather prominent; palpi slight, reaching the middle of the front, the terminal joint minute. Tongue moderate in length. Eyes hemispherical, prominent; ocelli distinct. Antennæ simple in both sexes. Front depressed, excavated, with a circular, sharp, somewhat irregular rim; in the center of the depression is a cylindrical projection with a truncate and somewhat cup-shaped tip. Thorax ovate, with smooth, scaly vestiture. Abdomen elongate, slender, cylindric, smooth. Legs slender, smoothly scaled, increasing in length posteriorly. Anterior tibia shortest, rather stout, with a moderately long, curved spine at tip; middle tibia with one pair, posterior with two pairs of spurs, not spinulose.



Venation and fore leg of Cerathosia.*

Primaries narrow, elongate, subequal, outer margin slightly oblique, arquate; 12-veined; accessory cell present; internal vein not furcate at base; veins 3, 4, and 5 nearly equidistant from the end of the median; 6 from lower margin of accessory cell; 7, 8, and 9 on a short stalk from the end of accessory cell, 8 to the apex, giving off 9 at about its middle; 10 from upper angle of accessory cell.

Secondaries large, rounded. Two internal veins; 2 from median at its outer third; 3 and 4 on a short stalk from the end of the median; 5 very weak, midway between 4 and 6; 6 and 7 from a short stalk at end of subcostal; the costal (vein 8) from the subcostal about two-fifths from base.

Supra anal plate of ♂ triangular; hook somewhat irregular, thickened

*The figure is incorrect in not showing vein 5 of secondaries; the vein is midway between 4 and 6, and is very weak—so weak as to be invisible in the recent mount in Canada Balsam, and in the best instance almost obsolete. The drawing was made from two slides newly mounted.

in the middle, with a pointed tip, but little curved. Side pieces subequal, with an obliquely curved tip.

C. tricolor Smith. Entom. Amer., 1887, vol. 3, p. 79.

Head, thorax, and primaries above, glistening pure white, spotted with black: secondaries and abdomen uniform glistening clay-yellow. Palpi black tipped; tip of frontal projection also black; a black spot at the inner base of antennæ. Collar with a black dot each side of the middle; thorax with four black spots, two on each side of the middle; patagiæ with two black spots.

Primaries with black powderings along costa, forming an elongate costal patch at outer third, in which are three white costal dots. The black spots on primaries are rather irregularly arranged and variable; there is a series along the median vein and another along the subcostal; in some specimens there are two rather indistinct transverse bands formed. At outer fourth is usually a sinuate, narrow, black transverse line, often broken up into spots and sometimes not traceable as a line; there is some difference, too, in the form of the line when it is present. A series of intra-venular spots parallel to and not far from outer margin always present; a series of terminal lunules; fringe white. Secondaries and abdomen immaculate. Beneath, secondaries and abdomen as above; abdomen with a more or less complete series of narrow black spots on each side of the middle. Legs white, black marked. Tarsi black or brown, ringed with white. Primaries yellow to near outer margin, where it is separated from the white terminal space by a broad blackish shading which extends inward on the costa. A series of black terminal lunules.

Expands, 1–1.37 inches=25–35^{mm}.

Habitat.—Texas.

This species seems locally common. It has been received by a number of collectors as well as by myself, but all the specimens are from the same source in southwestern Texas. It was collected at light. The armed fore tibia, combined with the clypeal protuberance, are, I believe, unique in the *Arctiidæ*.

ON A PERIDOTITE FROM LITTLE DEER ISLE, IN PENOBSCOT BAY, MAINE.

BY GEORGE P. MERRILL.

(With Plate XXXIV.)

In Dr. C. T. Jackson's Second Annual Report on the Geology of Maine, 1838, p. 45, there occurs the following passage:

Near the southern extremity of the island (Little Deer) we noticed a remarkable mass of greenstone trap, mixed with serpentine, which has burst through the strata of slate rocks and rises to the height of 150 or 200 feet above the sea level. This mass resembles the appearance of a volcano more nearly than any other spot I have seen in Maine. It here protrudes through the slate, which it has torn up all around, and melted in many places into a perfectly white hornstone or chert, while in other places the chemical action which took place has blown the whole mass into a sort of scoria or amygdaloid. The trap rock is mostly columnar and is broken into quadrilateral columns. A deep ravine separates the slate from the trap, so that it resembles a cone in the midst of a volcanic crater. Several dikes are sent off from the mass through the adjacent rocks.

Being in the vicinity of the island in the summer of 1887, the present writer took occasion to visit the locality above described and found it of sufficient interest to merit a more extended notice. Unfortunately, owing to the limited time at our disposal, our party was not able to discover all the points of interest described by Dr. Jackson, many of which have doubtless become more or less obscured during the lapse of nearly half a century since his report was written.

The mass of "trap" is easily seen from what is known as Deer Isle Landing, on the northwestern extremity of Deer Isle proper, the distance between the two islands being not more than half a mile at this point and the mass itself not more than a mile or possibly a mile and a half distant. From this point it appears in the form of a broad, rounded knoll or boss of a dull reddish-brown color, almost bare of vegetation, and backed by a higher hill of the white "hornstone" beyond. The knoll itself is locally known as "Pine Hill." On all sides in the immediate vicinity the land is wet and swampy, and covered for the most part by the dense, sometimes almost impenetrable, growth of spruces so characteristic of the region. This growth for a distance of several hundred yards from the base of the hill is sufficient to hide every possible contact of the erupted mass with the shales, and we could find nothing to indicate that the latter had been torn up and melted in the manner described by Dr. Jackson. The nearest observable outcrop of the shale was some 200 or 300 yards distant. This will be noticed later.

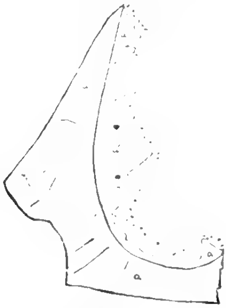
The mass of trap rises abruptly, with steeply sloping sides, to a height, presumably, fully equal to that given in the abstract. The rock is eminently massive, very compact, of a deep greenish-black color, weathering on the immediate surface to brownish, and breaking frequently into

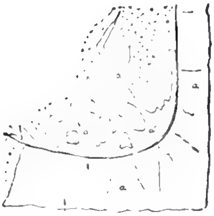
rough quadrangular blocks of all sizes up to several feet in diameter. Everywhere the rock is firm and fresh appearing, there being no disintegration from the effects of the weather, the reddish-brown discoloration on the surface, so far as observed, never extending to a depth of over one-fourth of an inch. The stone breaks with a smooth, slightly concave fracture, and presents to the unaided eye no crystalline secretions, though greenish flecks scattered uniformly through the mass indicate the presence of serpentine, and the general appearance of the rock is such as to suggest at once a peridotite, a suggestion which the microscope fully confirms.

The mass as a whole is remarkably uniform in color and texture. Indeed, with the exception of an occasional small vein of serpentine matter not over one-half an inch in width no observable difference could be found throughout the entire hill. So great uniformity in a mass of this size is rarely observed.

As seen under the microscope the rock is composed almost wholly of serpentinized olivine, augite, and scattering iron oxides. The augite occurs in broad plates, with deep, rounded embayments, and in long arm-like forms reaching out and enfolding the altered olivine, the peculiar habit of the mineral in acting as a binding constituent being here displayed in its best development. It is not markedly pleochroic in the thin section, varying only from nearly colorless or yellowish to a faint wine color. The mineral shows well-developed prismatic cleavages and gives extinction in sections parallel to $\infty P \grave{\infty}$ of almost exactly 40°. With the exception of the olivine and a few small grains of iron ore it is quite free from inclosures or cavities of any kind. In most cases it is beautifully fresh and unaltered; in others it is completely changed. The alteration in such cases begins with a bleaching and fraying out along the borders and cleavage lines, and by degrees the entire mineral becomes converted into an aggregate of faintly polarizing scales and fibers no longer recognizable as augite. In a few instances direct conversion into a greenish clorite was observed, but in no case does secondary hornblende or black mica appear.

The most interesting feature of the augite is that shown in the accompanying outline sketches and somewhat indistinctly in Figs. 2, 3,





and 4 of Plate XXXIV. On casual inspection by ordinary light the mineral presents no features other than of the ordinary type, the rounded

forms of the altered olivine abutting closely against the fresh augite, while the line of separation is perfectly sharp and distinct, as indicated by the continuous curved line in the sketch. Here the portions marked (*a*) represent in each case portion of a single augite individual. More careful inspection, however, shows that in nearly every instance the augite is surrounded more or less completely by a narrow and very irregular border, which projects in the form of sharp teeth or tongue-like prolongations for a considerable distance into the serpentine (olivine) granules. This is shown in the portions marked (*á*) in the sketches, and is very conspicuous when the section is viewed between crossed nicols. This irregular border I am inclined to consider a true secondary growth of augite, formed since the consolidation of the rock and analogous to the hornblendic, feldspathic, and quartzose enlargements described by Becke,* Irving,† and Van Hise.‡ I am led to these conclusions from a consideration of the following facts: (1) It would seem extremely improbable that the augite first separated from the molten magma in such irregular forms; (2) the original outline of the augite is perfectly sharp and smooth, eminently characteristic of augite outlines in this class of rocks; (3) the new portion is much the lighter in color, being, in fact, so nearly colorless as at first to be wholly overlooked when examining the section by ordinary light; (4) it projects in very irregular and jagged forms into the serpentine (olivine: the dotted areas in the sketch). Indeed, its appearance is such as to suggest that not only was its formation subsequent to the consolidation of the rock, but that it is an accompaniment of the alteration, the sharp, tooth-like edges projecting into the olivine along the curvilinear lines of fracture much like the ordinary beginnings of serpentinization. The new growth in all cases possesses the same crystallographic orientation as the original, the entire mass as figured extinguishing simultaneously between crossed nicols. That the growth is augite, and not hornblende, as in the cases described by Van Hise, is shown by its colors of polarization, which are identical with those of the augite and of equal intensity, and by the angles of extinction, which are the same as that of the original augite. In some cases the new growth takes on beautifully delicate and branched forms, the mineral ramifying along the fracture lines of the olivine in such a way as to remotely resemble the eozoon structure.*

I have gone so much into details regarding these structures for the reason that, so far as I am aware, the phenomena of secondary enlargements of augite have never before been observed. Indeed, the well-known habit of the mineral in passing into uralitic hornblende has, I

* Min. u. Pet. Mittheil., Vol. v, 1883.

† Bull. U. S. Geol. Survey, No. 8, 1884.

‡ Am. Jour. Sci., May, 1887.

* The above described peculiarity of the augitic constituent was made the subject of a brief paper by the writer in the American Journal of Science for June, 1888, p. 488.

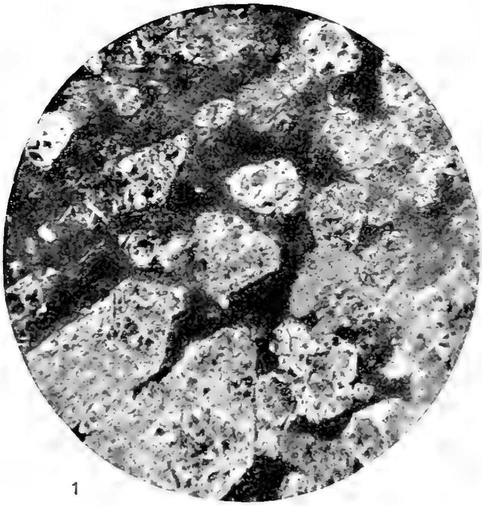
March 12, 1889.

think, lead petrographers in general to regard it as a product only of high temperature, and hence not to be looked for under such circumstances or conditions as the hornblendic and feldspathic enlargements to which allusion has been made. The fact that the mineral reaches out in slender, thread-like prolongations into the curvilinear fractures of the olivine shows beyond controversy that so much of the mineral has formed subsequent to the fracturing of the olivine. That it was not all so formed is shown by the well-defined curved borders abutting fairly against the olivine pseudomorphs. At present I can see no possible explanation of these structures other than to consider them as secondary, if indeed not contemporaneous in origin with the serpentinization of the olivine.

Fully one-half the interstitial spaces of the olivine are now occupied by a very light greenish chloritic substance, almost colorless in the section and without action on polarized light, so that between crossed nicols the now serpentinized olivines appear as if set in a black frame. (See Fig. 1 of Plate XXXIV.) These areas are precisely similar to those occupied by the augite, and the first suggestion that offers itself is that the amorphous material is the ultimate product of the augitic alteration. Indeed, in some cases it is possible to trace the fresh augite through its various stages of alteration until a somewhat similar product is reached. In other cases, however, the fresh augites abut fairly against and even inclose areas of this amorphous material in such a manner as to force one to the conclusion that it represents the original unindividualized base. The olivine, which constituted originally fully two-thirds the mass of the rock, has in nearly every case examined gone over into a serpentinous product. That the mineral was undoubtedly olivine is shown by the outline of the serpentine pseudomorphs, as well as the irregular net-work of curvilinear fracture lines along which the serpentinization has proceeded. The process of change has gone on with the separation of free iron oxides in the manner so well known as to need no further notice here.

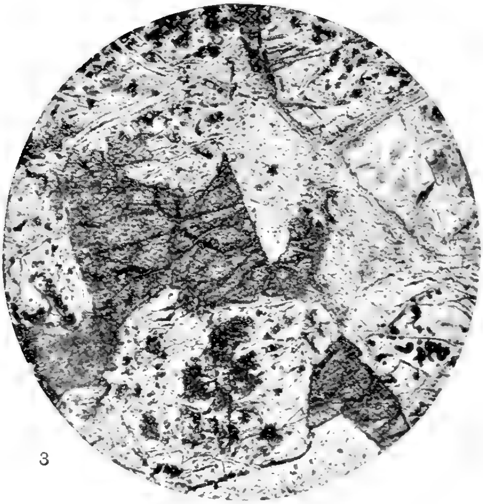
Magnetite occurs in abundance both as original and as a secondary constituent from the serpentinized olivine. Chromic iron is also present in beautiful minute octahedra with a brilliant luster. It is not in all cases possible to distinguish between the two ores by the microscope, and as both were attracted by the magnet the presence of chromium was determined by testing the separated ores in the borax bead. Tests failed to show even a trace of titanium. Traces of a plagioclase feldspar, although indicated by the analysis, are scarcely discernable in the section. In but a few instances nearly amorphous chloritic areas were observed still showing scarcely recognizable cleavage lines and twin striæ.

Besides the mineral above named, the slides show occasional small prisms of apatite and rarely clusters of long, colorless, parallel-lying needles, tapering gradually toward one end, and with frequent trans-

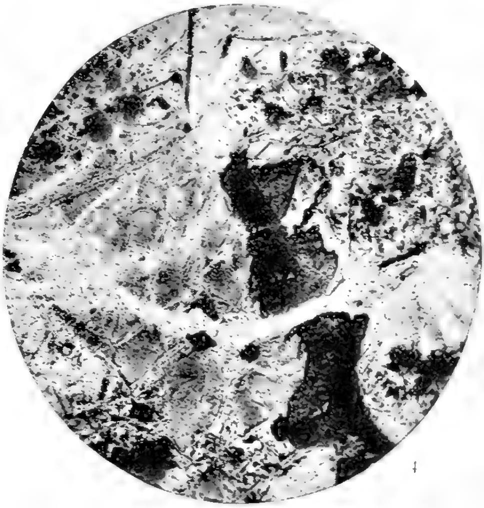


1

2



3



4

MICROSTRUCTURE OF PERIDOTITE, LITTLE DEER ISLE, MAINE. (Pages 191-195.)

FIG. 1. Section magnified about 20 diameters. The white mottled areas are serpentinized olivine. The gray, shown indistinctly only at the right, is augite, and the black interstitial matter altered base (?). (Section 39044 a.)

FIGS. 2, 3, 4. The same magnified about 40 diameter, showing enlarged augites. (Sections 3 044-b and 39044-c.)

verse jointings. These polarize only in dull colors, give extinctions parallel to the axis of elongation, and are believed to be sillimanite. Besides these are occasional minute elongated crystals, quite opaque, and with a bright, brassy-yellow reflection, which are doubtless pyrite.

The above completes the list of determinable constituents. The rock belongs, therefore, to the variety of peridotite called *picrite* by Professor Rosenbusch. A partial analysis by Mr. L. H. Merrill, of the Maine Experiment Station, yielded results as follows:

	Per cent.
SiO_2	38.01
Al_2O_3	5.32
Fe_2O_3	6.70
FeO	4.92
MgO	23.29
CaO	4.11
K_2O	.22
Na_2O	4.15
Ignition	10.60
Specific gravity	2.83

The nearest observed outcrop of the shale was some hundred yards distant. The rock has become indurated until it is now a very fine and compact quartzite, weathering whitish, and somewhat resembling on casual inspection a weathered felsite. As an equal amount of induration exists in samples collected a long distance from the outcrop, and moreover, as is well known, contact metamorphism in rock so basic in composition is reduced to a minimum, I can not consider this induration as at all dependent upon or connected with the ejection of the mass of peridotite. The results of the violent chemical action so graphically described by Dr. Jackson are no longer apparent, if, indeed, they ever existed.

A thin section cut from a specimen taken from a dike some 6 feet in width, lying nearly in a direct line between the peridotite and Deer Isle Landing, showed the rock to be a diabase of the ordinary type.

NATIONAL MUSEUM, *March* 10, 1888.

DESCRIPTION OF THE ADULT MALE OF ACANTHIDOPS BAIRDI.

BY ROBERT RIDGWAY.

The specimen described below, probably the first adult male obtained of this exceedingly rare species (described in Vol. IV, p. 336, of these Proceedings), was recently presented by the National Museum of Costa Rica to that of the United States, through the courtesy of Mr. Anastasio Alfaro, director of the first named establishment, and Mr. José C. Zeledon, discoverer of the original type specimen.

The adult male of *Acanthidops bairdi* resembles very closely in coloration that of *Haplospiza unicolor*, of Brazil, but is darker and less of a bluish cast, both above and below, and has the under mandible chiefly light colored. Not having a specimen of the Mexican *H. uniformis*, I am unable to point out with exactness the differences from that species; but judging from the description and remarks given by Messrs. Salvin and Godman in *Biologia Centrali-Americana*, *Aves*, pp. 366, 367, it seems to come much closer to that species, if it be not actually the same! It would appear, however, to have decidedly a shorter wing and longer tail, and longer tarsus than that bird. Whether or not it is the same species or congeneric with *H. uniformis*, there can be no doubt that it is generically distinct from *H. unicolor*, which has the bill much shorter and more typically Fringilline, the tarsi shorter, and the nostrils more exposed. There can, I think, be no question that *Acanthidops* comes very near to *Haplospiza*, and I am inclined to believe that the so called *H. uniformis* belongs to *Acanthidops* and not to *Haplospiza*, since Messrs. Salvin and Godman (*loc. cit.*) say that its chief differences from *H. unicolor* consist in "a larger bill and longer wings and stronger feet," as well as "rather darker" coloration. If this view of its relationship proves correct, we would then have a Middle American genus, *Acanthidops* and a related Brazilian genus, *Haplospiza*; the first with two species, *A. bairdi*, of the Costa Rican highlands, and *A. uniformis*, of southeastern Mexico. A case of somewhat anomalous geographical distribution would thereby be satisfactorily disposed of.

Adult male (No. 114907, ♂ ad., El Alto, Poas, Costa Rica, July 27, 1888; A. Alfaro).—Above uniform slate-black or blackish slate,* the concealed portion of the wing-feathers decidedly black, this showing distinctly, in the closed wing, on the remiges, which have only the edges dark slaty; under parts plain slaty, lighter than upper parts,† slightly paler posteriorly, the flanks tinged with light olive-brownish and under tail-coverts rather broadly bordered with the same. Upper mandible brownish black, lower dull whitish, passing into dusky brownish on terminal third and on basal portion of gonys; legs and feet horn-brown. Length (skin) 5.50, wing 2.60, tail 2.35, exposed culmen .55, tarsus .85, middle toe .60.

* Very close to Fig. 2, Plate ii, of my "Nomenclature of Colors."

† Intermediate in tone between "slate-color" and "slate-gray" of my "Nomenclature of Colors."

THE HOUSES OF THE KWAKIUTL INDIANS,* BRITISH COLUMBIA.

BY DR. FRANZ BOAS.

No. 130414 of the Catalogue of the Ethnological Collections of the U. S. National Museum is a model of a house from Fort Rupert, British Columbia (Fig. 1). Though the model is very rough it is of considerable interest, as it shows the carved posts which are characteristic of these houses and as the figures in it represent one of the winter dances in which masked men make their appearance.

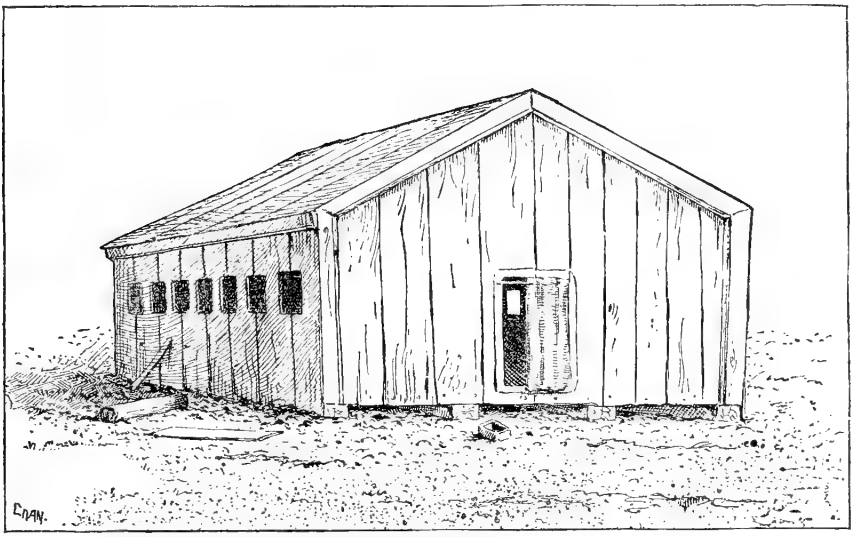


FIG. 1. Model of a Kwakiutl house, Fort Rupert, B. C. 130414.

In the following pages I shall describe the plan of the Indian house and the meaning of the posts according to observations made in British Columbia, 1886–'87. The model is a plain wooden house with a gable roof, one side of which is moveable on hinges, thus allowing the student to look into the interior. The door is covered with a curtain, and windows admit the light. The pieces of wood forming the walls of the house are nailed to a frame. This arrangement does not correspond to the real arrangement of the Indian house, as will be seen by the follow-

* In the present paper the alphabet of the Bureau of Ethnology has been adopted. The vowels are pronounced as in Italian, the consonants as in English, with the following exceptions and additions:

e̥ = e in power.
c = sh in shoe.
q = ch in German bach.
ɥ = ch in German ich.
ʞ = guttural k, almost kr.
ç = th in thin.
tl = an explosive sound produced by laying the back of the tongue against the palate and pressing forth the air on both sides of the tongue.

ing description, but the posts and the timbers carrying the central part of the roof are exactly like those of the houses. The houses of the

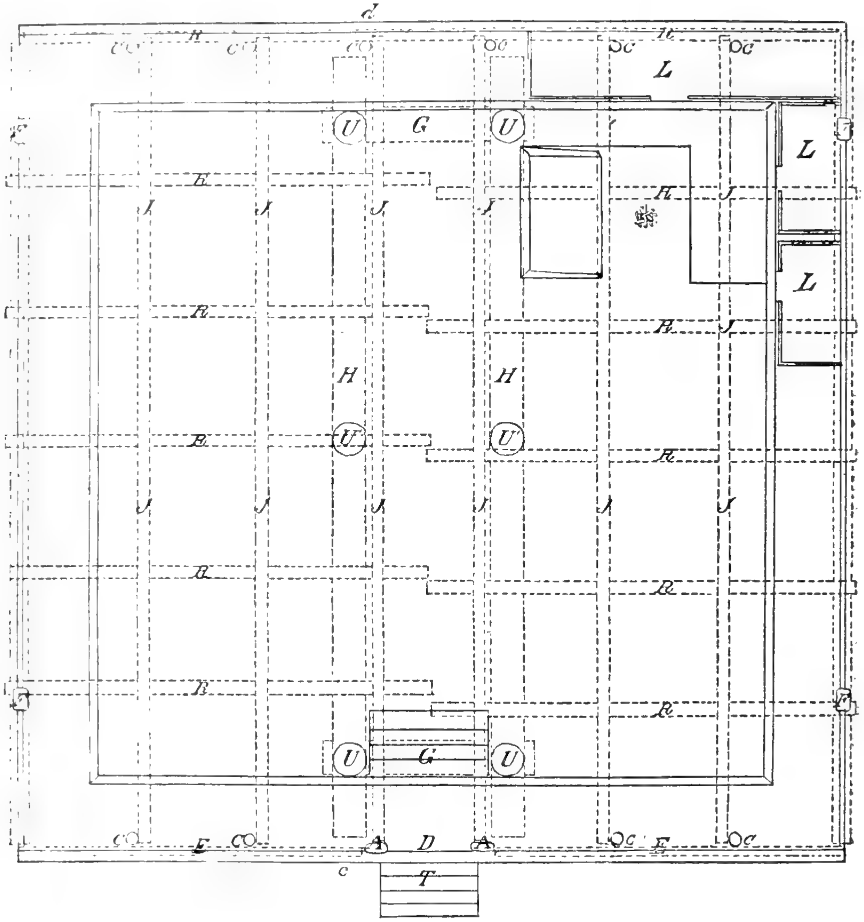


FIG. 2. Ground plan of Kwakiutl house.

Kwakiutl and their neighbors form a square, the sides of which are from 40 to 60 feet long (Figs. 2, 3, 4). The door (*D*) is generally in the center of the side nearest the sea, which forms the front of the house. The

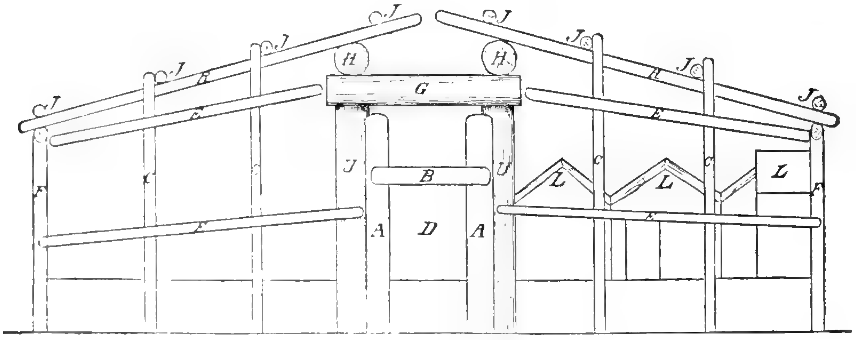


FIG. 3. Construction of Kwakiutl house. Front elevation.

latter has a gable roof, the ridge of which runs from the front to the rear. The walls consist of boards, which are fastened to a frame-work

of poles. The sides of the door are formed by two posts (A) from 6 to 8 inches in diameter and standing about 4 feet apart. Over the door they are connected by a cross-bar (B, Fig. 3). Sometimes this frame-work of the door consists of heavy planks. The frame-work of the house front

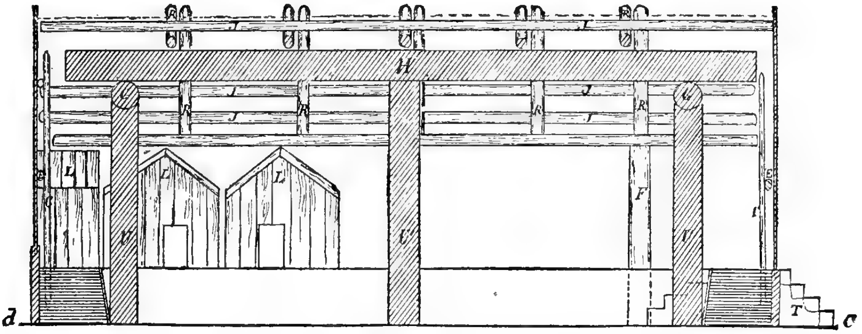


FIG. 4. Construction of Kwakiutl house. Longitudinal section, from *c* to *d*.

consists of two or three vertical poles (C), about 3 inches in diameter, on each side of the door. They are from 8 to 10 feet apart. Their length diminishes toward the sides of the house according to the inclination of the roof. These poles are connected by long cross-bars (E), which are tied to their outer side with ropes of cedar bark at half the distance between the roof and the ground. The frame-work of the rear part is similar to that of the front, but that of the sides is far stronger, as it has to support the roof. Two heavy posts (F) about 9 inches in diameter are erected. Their heads are cut out and a beam of the same diameter is laid over them. At the joints it is cut out so as to fit into the heads of the posts. On both sides of the door and in the corresponding part of the rear side, about 3 feet distant from the central line of the house, the supports of the roof (U) are erected. These form the principal part of the frame-work, and are the first to be made when the house is built. They stand about 3 feet from the walls inside the house These uprights are about $1\frac{1}{2}$ feet in diameter and are generally connected by a cross-piece (G) of the same diameter. On each side of the cross-piece rests a heavy beam (H) which runs from the front to the rear of the house.

Sometimes these beams are supported by additional uprights (U'), which stand near the center of the house. The rafters (R) are laid over these heavy timbers and the beams forming the tops of the sides. They are about 8 inches in diameter. Light poles about 3 inches thick are laid across the rafters. They rest against the vertical poles (C) in the front and rear of the house, and are fastened to the rafters with ropes made of cedar bark. After the heavy frame-work which supports the central part of the roof is erected a bank about 3 feet in height is raised all around the outlines of the house, its outer side coinciding with the lines where the walls are to be erected. Long, heavy boards 4 or 5 inches thick are implanted lengthwise along the front of the house, their

upper edges standing $2\frac{1}{2}$ or 3 feet above the ground. Then the earth forming the bank is stamped against them, and thus a platform is made running along the front of the house. Later on this is continued all around the house. The frame-work of the front is the next to be erected, the poles (*C*) standing in the earth forming the platform. The upper edges of the front boards which were implanted into the ground are grooved, and in this groove the boards forming the front wall stand. They are tied or nailed to the cross-bar (*E*) and to the foremost rafter, which is connected with the frame-work of the front. The next thing to be done is to make the rear wall and the sides. The former exactly corresponds to the front, the door only being wanting. The boards forming the side walls are implanted into the ground, standing vertically, their upper ends being tied to the beam forming the top of the frame-work. The platform running along the inner sides of the walls is finished by stamping the earth against the side walls. The roof consists of a peculiar kind of boards, which run from the gable to the sides of the house and rest on the beams (*F*). They lap on their edges like Chinese tiles. This arrangement has the effect that the rain runs from the roof without penetrating into the house. The house front is generally finished by cutting the boards off along the roof and by finishing them off with a molding. Three blocks are placed in front of the door, forming steps (*T*) that lead to the platform. Three steps of the same kind lead from the platform to the floor of the house. The board forming the inner side of the platform slopes slightly inward. The house has no smoke escape, but several of the boards forming the roof can be pushed aside. During the night these openings are closed, but in the morning one board over every fire place is pushed aside by means of a long pole. As it is necessary to look after the roof from time to time, a stationary ladder is leaned against the side of the house. It consists of one-half of the trunk of a tree or of a heavy board, into the upper side of which steps are cut.

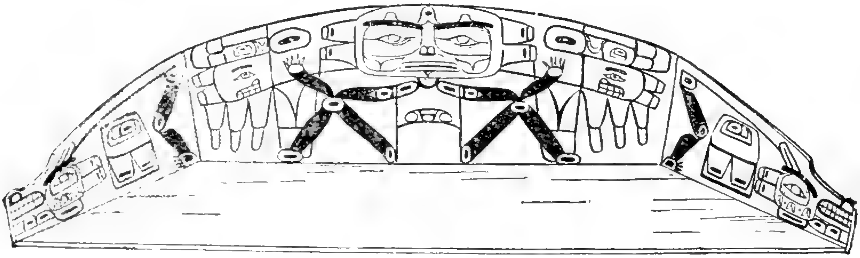


FIG. 5. Carved settee in a house at Qumta'spē (Hope Island).

The house is inhabited by four families, who occupy the four corners, and each of whom has a fire-place of its own. The corners belonging to each family are divided off from the main room by a rough frame-work of poles, the top of which is used for drying fish or other sorts of food. In the villages at the northern end of Vancouver Island a peculiar kind of frame is used for this purpose, while farther south poles are

laid across the frame-work. On each side of the fire stands the immense settee (Fig. 5)*, which is large enough for the whole family. It has no feet, is about 7 feet long and 4 feet deep, and its sides slope slightly backward, so as to form a convenient support for the back. Boards are laid along the foot of the rear and front platform and on the side of the fire opposite the settee. The arrangement is sometimes made a little different, the settee being wanting, or in some instances standing on the rear side. This depends on the arrangement of the bedrooms (*L*). These bedrooms have the form of small houses which are built on the platform running around the house. Most of these bedrooms have gable roofs, and their fronts are finished off with moldings. The section of *cd* (Fig. 4) explains the arrangement better than any description can do. Sometimes these rooms are enlarged by adding a low extension to the house, the floor of which is elevated as high as the platform. In the center of such rooms there is a small fire-place. The plans of the houses of the separate gentes show slight differences. In some instances the heavy beams (*H*) rest on the uprights (*U*), the cross-piece (*G*) being

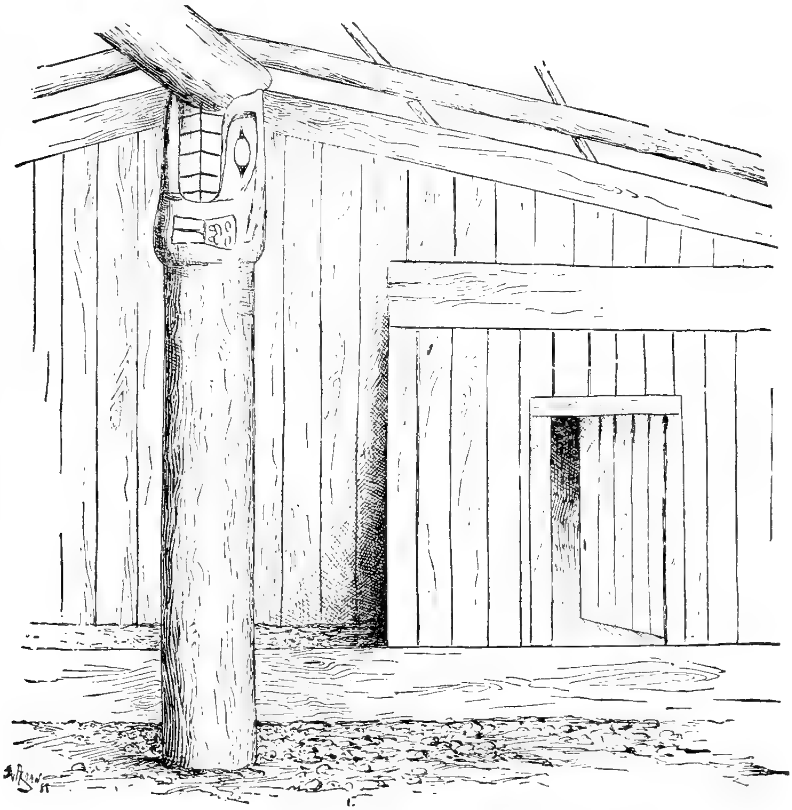


FIG. 6.—View of the rear part of a house in Qumta'spē.

wanting (Fig. 6); in other instances there is only a single timber (*H*) resting on the center of the cross-piece (*G*). Certain large houses that

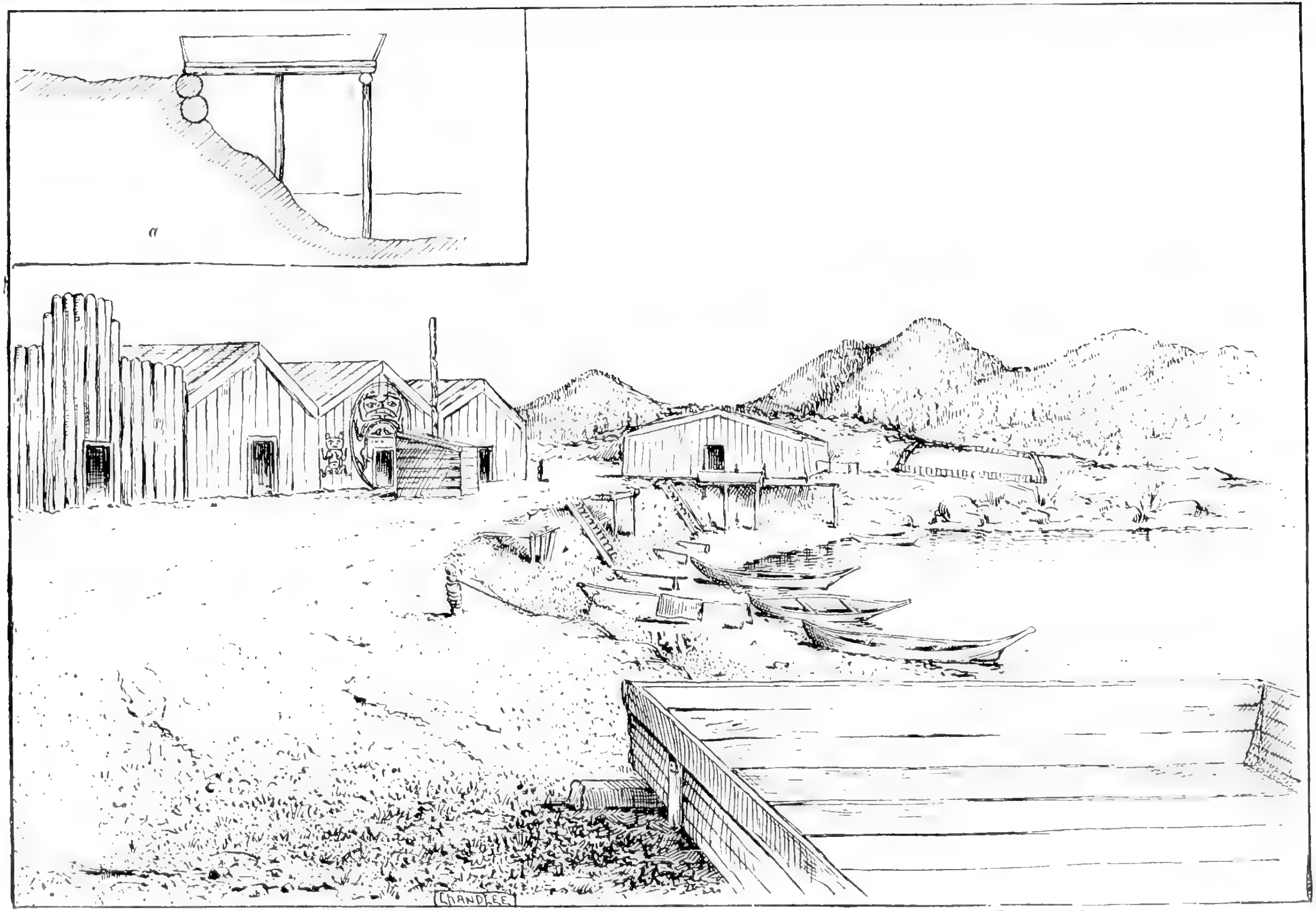
* The figures are from sketches by the author.

belong to the greatest chiefs have a number of steps or platforms, numbering from 2 to 4, instead of a single platform of the house described here. These steps either run all around the house, giving it somewhat the appearance of an amphitheater, or are confined to the rear side. In traditions houses are mentioned with ten steps. Each house has its name, as will be seen from the view of the village of Qumta′spē, on Plate XXXVIII, in which the names of four houses are given. In front of the village the Ōkuiuā′tlē bight is seen, bounded by the narrow point Tla′sōta, on which the natives grow some potatoes on a small inclosure. Behind this point the hills of Galiano Island, Kaqaqtlā′ and Wē′qōcoa are seen which are frequently mentioned in the legends of these tribes. The island is divided from Hope Island by the Strait of Ōqsâ′.

The houses generally face the beach and are built in a row. (See Plate XXXVIII.) In front of the town there is a street, which is carefully leveled, the lower side being supported by an embankment of heavy logs. From here steps lead down to the beach, where the canoes are lying. Opposite to the houses, on the sea side of the street, there are platforms, on which the Indians pass most of their time, gambling and conversing. The platform rests on a frame-work of poles and on the embankment of the street, as shown in Fig. *a*, Plate XXXVIII.

Among the tribes speaking the Heiltsuk dialect and among the Bilqula the same kind of house is in use, with slight deviations. The house rests on piles in the same way as the platform of the Kwakiutl does, only the rear part resting on the ground. It may be, however, that the character of the ground accounts for this method of building wherever it is applied, as it is difficult to level a slope of steep grade, and in such cases it will be more convenient to support the house by piles. The same style of house is used from Comox, on Vancouver Island, to Dean Inlet. Farther north the Haida house, which, although similar, has some peculiarities of its own, is found, while farther south the immense long houses of the Salish coast tribes are used. But to return to the Kwakiutl house: The uprights are always carved according to the crest of the gens of the house-owner. In the model they represent men standing on the heads of animals (Figs. 7, 8, 9). Before discussing these carved posts a few remarks of a general character will be made. The tribes of the northwest coast of America are all divided into gentes. But while among the northern peoples, the Tlingit, Haida, Tsimshian, and Heiltsuk, the child belongs to the mother's gens, it belongs to that of the father among the Kwakiutl and Salish. All these tribes claim to be autochthonous. According to their traditions the ancestor of each gens descended from heaven, in most cases in shape of a bird, and became a man. The crest he adopted hints at certain exploits that he has made.

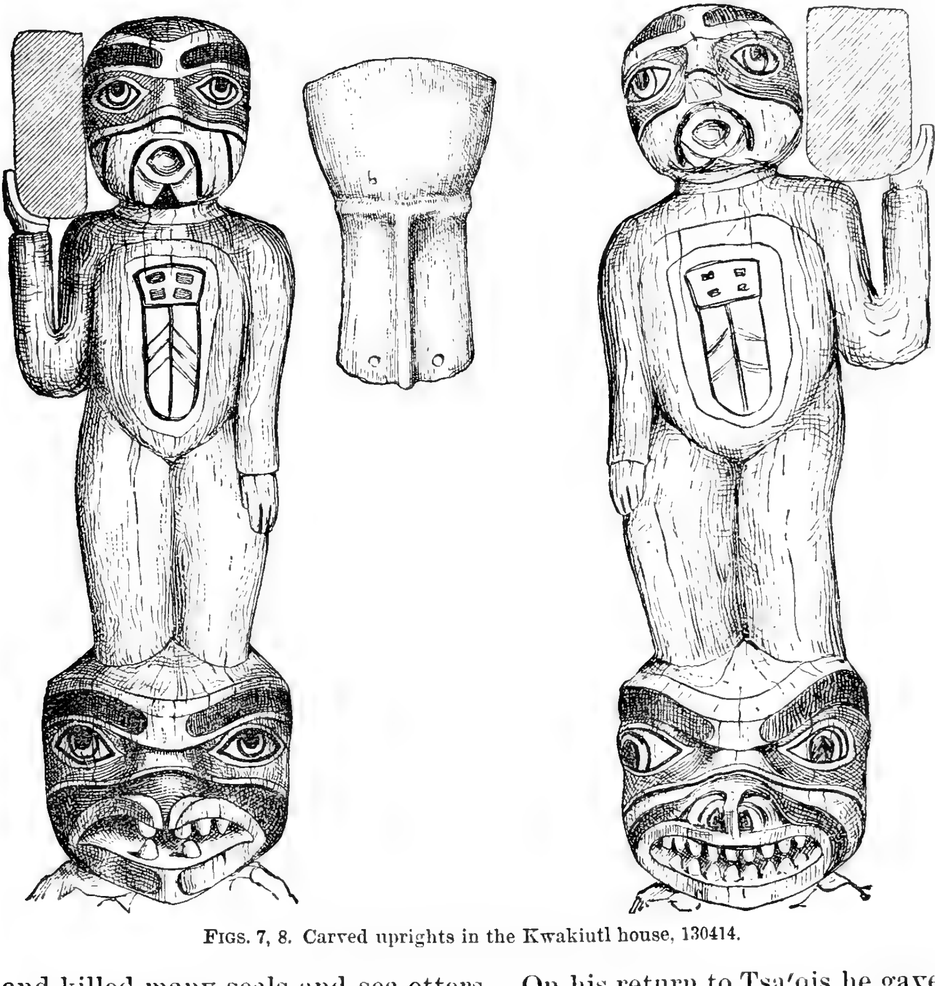
I shall give a few characteristic traditions that show the connection between the carvings in the house, the masks, etc., with the legends referring to the ancestors of the gentes.



Omatsems. Wātsuqūioa. Kinā'n'amas. *Wē'qōeoa.* Mā'tlempaias. *Kaqaqtlā'.* *Ō'KUIUĀ'TLE.* *Tlā'sōta.*

VIEW OF THE VILLAGE QUMTA'SPĒ, OF THE TLATLASIĸOALA AND NAĸÓMKILIS TRIBES, ON HOPE ISLAND, B. C., COMMONLY CALLED NEWETTE. (Page 212.)

(1) Walasnomō'qois = the great Nomō'qois (a gens of the Kwakiutl). Walasnomō'qois descended from the sun to the earth and built a house in Tsa'qis (Fort Rupert). His son was Ōm'aqtā'latlē. The latter saw many seals and sea-otters on the island Mā'msiqtle (Shell Island). As he had no boat he took a log of driftwood instead, went to the island



FIGS. 7, 8. Carved uprights in the Kwakiutl house, 130414.

and killed many seals and sea-otters. On his return to Tsa'qis he gave a feast and gave away numerous otter skins and many boxes of seal oil. Then he went to Gyōky (= house, a place about 3 miles east of Fort Rupert) and ascended the river that discharges its waters there. Near the sources of this river he met a man by the name of Mā'kakyu, who gave him a boat. Then Ōm'aqtā'latlē wandered eastward and in the country of the Ma'malēlēqala he met with Mawatsileqála, who was of the Tsawat'ēnoq tribe. He went with him to his house and took Mawatsileqála's daughter, Häaqqolā'tlemēqa, for his wife. His father-in-law gave him the emblems of his gens and after his return to the Kwakiutl country Ōm'aqtā'latlē built a new house in Ky'ā'qa, the posts and beams of which he carved according to the emblems he had received in the land of the Tsawat'ēnoq. The two uprights in the front part of the

house represent two men: Yē'ɥent'eɥa (something talking inside) and Wawēqēmitl (the orator). The uprights in the rear of the house also represent men: Lēqe'laqsta (the braggart) and Hasaɥawā'sui (attempting to talk louder than anybody else). The uprights in front of the house support the beams that represent the Sisiutl (a double-headed snake), while those in the rear of the house are connected by a cross-piece representing a Sisiutl (or wolf?), upon which the beams rest. The hinges of the house door are at its upper edge. It is very heavy and crushes every bad man who attempts to enter the house. His dancing mask was called Ōlikyen, and represented a wolf; the dance in which it is used is called Walas-aqā'k (something great coming from above).

FIG. 9. Carved upright in the Kwakiutl house, 130414.

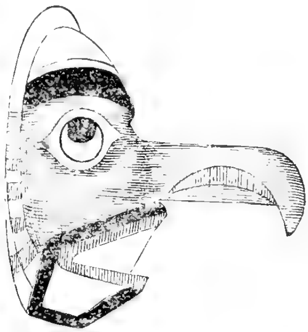


FIG. 11. Sun mask.

When the house was finished Ōm'aqtá'latlē gave a great feast, and the beams and uprights of his house began to move. The Sisiutl played with their tongues. The men began to talk and told the Sisiutl to kill all enemies of their master.

(2) Sentlaē (a gens of the Tlauitsis, Nimkic, Náɥoartoɥ, and Kwakiutl).

Sentlaē, the sun, descended from heaven in shape of a bird and was transformed into a man. He built a house in Yiɥ'ā'men. Thence he wandered to ɥomoks and married a woman of that tribe. He visited the Tlauitsis, Nimkic, and Na'ɥoartoɥ, and married a woman of each of these tribes. At last he came to Tliksī'waē, in the country of the Kwakiutl, and built a house in ɥ'aioq. There he remained. He took a wife among the Kwakiutl, and they had a son who was called Tsɥtsā'lis.

On his house front a sun is painted on each side of the door. The uprights represent men carrying suns. Their name is Lelā't'otpes and they were slaves of Sentlaē. The cross-bars connecting the uprights are also men, the beams sea-lions. Three steps lead up to the door. They represent men whose names are Tlē'nonis. The heraldic column of the gens, called Sentlē'qēm, is shown in Fig. 10. It represents a series of coppers, one standing upon the other. On top of the coppers there is a man extending his arm as though he were talking. His name is

Lā′qt'ōtpes (sing. of Lela′qt'otpes = he who gives presents to strangers only). The top of the column is the Tlē′selaqẹmtḻ, a mask representing the sun surrounded by wooden rays. In the dance Tsā′eꭗa they use the sun mask (Fig. 11); in the dance Yā′uiqa the dog mask Ku′loqsa. This name is said to mean the sun shining red through the mist.

A simpler form of the column of this gens may be seen in Fig. 12, where, as in the last case, the face of the sun is fastened to the top of a pole.

(3) Kuē′qakila (a subdivision of the gens Omeatl of the tribe Tlatlasiꭗoala). Omeatl, the raven, had a daughter, Hā′taꭗa. Once upon a time Hā′taꭗa ate sea eggs that she had caught, although her father had forbidden her to do so. In his anger he ordered all the inhabitants of the village to remove and desert her. The poor girl, when left all alone, made a fish-basket of cedar twigs and tried to catch fish on the beach. One day she found a young man in the basket, the son of ꭗomō′ꭗoa, the spirit of the sea, who brought her a huge whale and became her husband. By him she had a son, Kuē′qakila. The boy used to paddle about in his boat, and on one occasion he found the head of a whale that was eaten by the raven. He took it into the boat, and then he discovered that he had found the Sisiutl. The fish began to move his fins, and thus propelled the boat. Later on Kuē′qakila descended into the sea to his father, ꭗomoꭗoa. Four days he remained there and left with many gifts. But when he returned he found that he had been four years in ꭗomoꭗoa's house. Among the gifts he had received was the heraldic column, which is since that time used by that gens (Fig. 13). The lowest figure represents the Tsonō′ꭗoa. On top of it is a Bekuc with a split skull (=man, a spirit of the sea with long hair), standing on his head; the next figure is an-

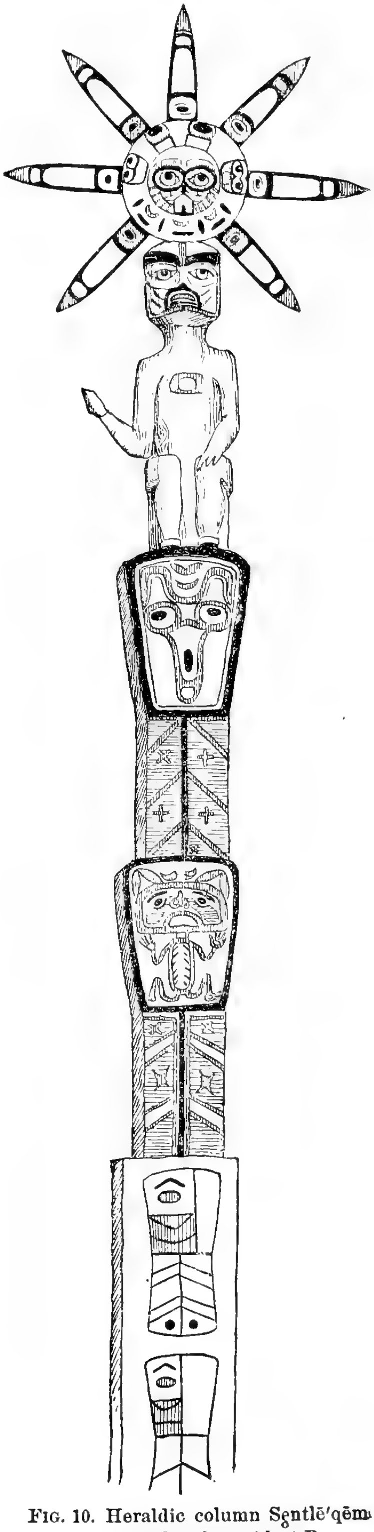


Fig. 10. Heraldic column Sẹntlē′qēm of the Gens Sẹntlaē; Alert Bay.

other Bekue. On top of it a wolf is standing, whose fore paws are in the mouths of two human heads. On top of the wolf sits a beaver, and the uppermost figure is the halibut. The two boards bearing the English inscriptions were nailed to the house by a white trader. But I should advise future explorers not to trust the man 'Cheap' (a corruption of "chief"), as he is the 'greatest liar' on the whole coast. Formerly the Sisiutl was painted on the front of the house, but at the request of the Indian agent, Mr. Cheap, whose proper name is ꭓomena'kulu, whitewashed it, and unfortunately I could only see a few faint traces of the painting. In consideration of this action he was appointed constable and presented with an old uniform and a flag. It was made his special duty to prevent dances and feasts, and since that time he dances in this uniform and with the flag. I found the characteristic Sisiutl on a settee in his house (Fig. 5). Part of the rear of this house is shown in Fig. 6. The upright that holds the central beam in its mouth represents the sea lion.

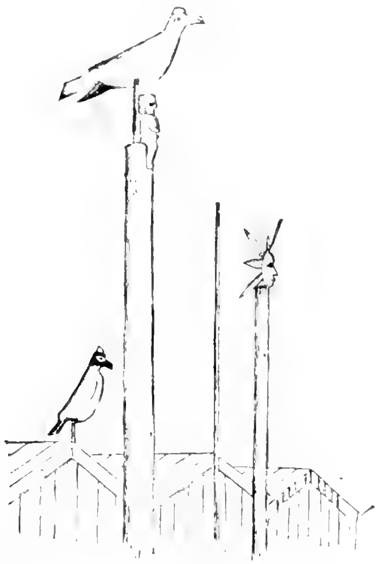


FIG. 12. Gables of houses at Alert Bay.

(4) Nōmase'nqilis (a gens of the Tlatlasiꭓoala).

Nōmase'nqilis descended from heaven and built a house. On his heraldic column were two eagles that watched his house. He had three children—a blind daugther, Aikyā'oeꭓa; a son, Tleqyā'likila; and a daughter, Naqnaisilaō'ꭓoa.

One day Aikyā'oeꭓa wanted to go to Yaꭓamā'lis (Hope Island) to pick berries. A slave accompanied her in her boat, and when after a long time they had not yet arrived in Yaꭓamā'lis, though it was only a short way off, she asked, "Where are we? We ought to be in Yaꭓamā'lis by this time." The slave answered, "I do not know. I do not see Yaꭓamā'lis, nor do I see the eagles on the post before your house." They sailed a long time without seeing land. At last an island loomed up on the horizon, and in coming nearer they saw a town. There lived Tlā'ꭓoakila (*i. e.*, with copper plates). When he saw the boat he invited the travelers to enter his house, and he took Aikyā'oeꭓa for his wife.

Nōmase'nqilis, however, mourned his daughter as though she were dead. His heart was very sad, and he threw the post of his house into the sea. The tide carried it to Yaꭓamā'lis, where Nomase'nqilis built a new house.

Aikyā'oeꭓa had two children, Tla'ꭓoakila and Tlā'sutewalis. One day she left them playing near the fire while she went to the beach to

get clams. The children in playing about fell upon the feet of their grandmother. At last she got angry and said, "Now, don't bother me. I do not even know where your mother comes from." The little ones felt unhappy, and when their mother returned they asked, "Mother, where is your home? Grandmother says she does not know where you came from." The mother replied, "I went with a slave in my boat. For many days we drifted to and fro and at last we reached this coun-

Fig. 13. Kuē′qakila's heraldic column at Qumta′sqē.

try." "Oh, make us happy," cried the children, "let us go and see our grandfather." Then she told them that he was a mighty chief. Their father gave them his copper boat, which he filled with copper plates, and Aiqyā′oeqa said to them before parting, "Before you come to my home you will hear the eagles cry on our post." They started, and after a long journey they heard the eagles on the post, and now they knew that they were near Nōmase̥′nqilis's house. They gave him the copper

plates, and all the people admired their copper boat, the copper paddles, and the copper bailer. They staid for some time with the old man, but then they returned home. Their grandfather gave them costly skins and blankets before they left.

Later on Ɥanikila (*v. infra*) transformed Nōmase'nqilis into a stone. Tlēqyálikila, Nōmase'nqilis's son, emigrated at that time to Quspalis, where he built a new house. His son was Tsē'selaso, who had three sons, O'maliqstē, Wa'lasɥoa, and Kya'lɥamistal. O'maliqstē was angry with the toads that croaked every morning in the woods. He ordered them to be silent, and since that time they do not croak any more. Kya'lɥamistal carved a human figure out of cedar, to whom he gave life by pointing with his finger toward it. He gave him the name Wā'-tsiɥsta. A statue representing the man stands in the house (Fig. 6) by the side of the bed-room, but has unfortunately been omitted by the draughtsman.

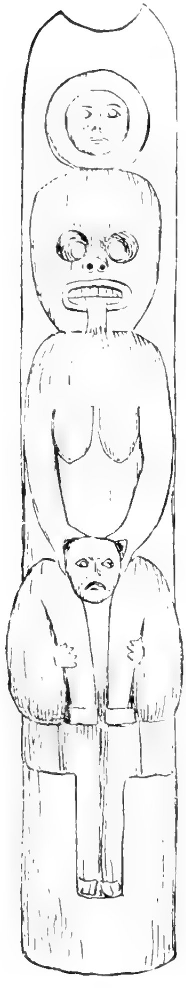
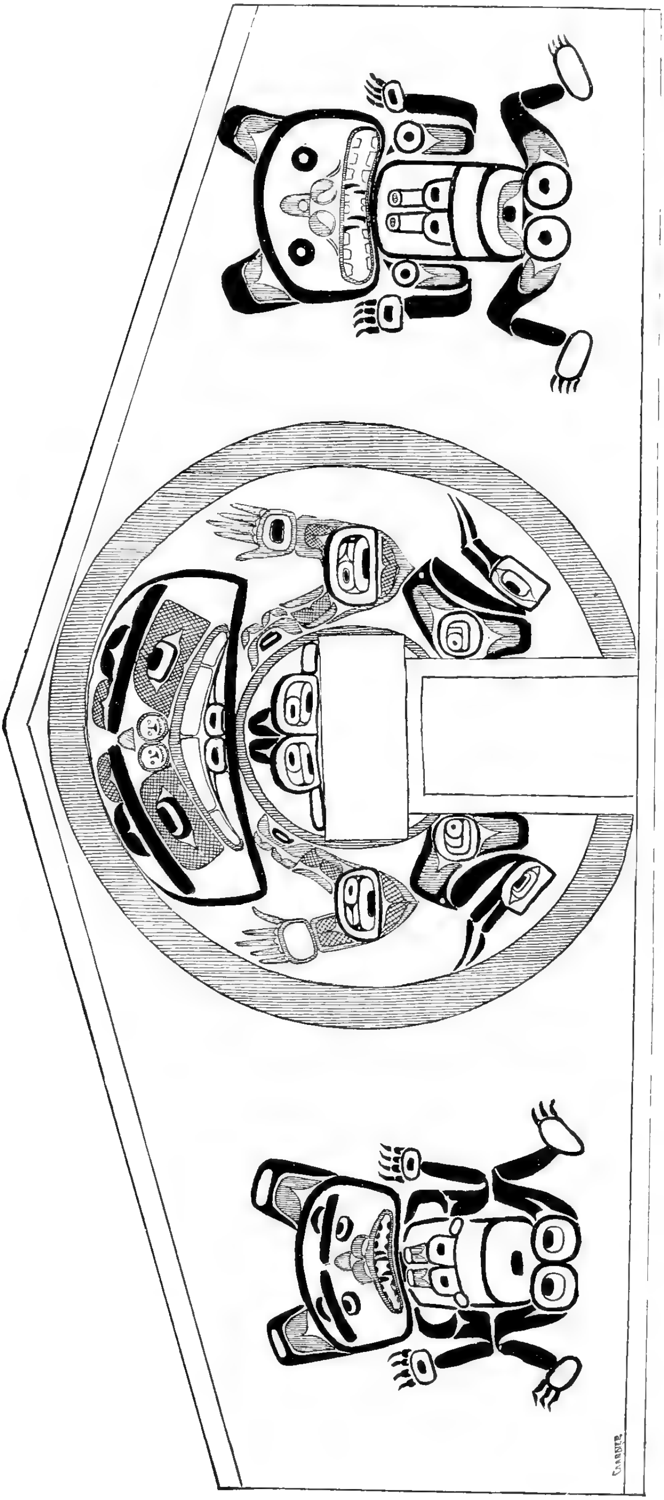


FIG. 14. Post in house in Qumta'spē, showing moon and Tsōnō'ɥoa.

I can not give the numerous traditions connected with these houses, but shall describe the emblems of a few other gentes. The uprights in the rear of the house of the gens Lalaqsint'aio of the Kuē'tela tribe represent each a Tsonō'ɥoa standing on the head of a bear that holds the Tsonō'ɥoa's feet. The latter carry the beams. In the front of the house the beams rest on a cross-bar representing a sea-lion. The uprights supporting the latter are seals holding the sea-lion in their mouths.

The gens Tsinqɥaio of the same tribe has a house with several platforms and a post with two eagles on its top standing in front of the house.

The house front (see Plate XXXIX) and the upright (Fig. 14) belong to the gens Kyā'loyaɥamē, the moon. The central figure is the moon; the men in the center of the circles representing Kyā'loyaɥamē himself. The gens derives its origin from this man, who is said to have descended from heaven. On the sides of the door are two grizzly bears that another ancestor of the house-owner obtained from a Na'ɥoartoɥ chief. The upright consists of two figures. The lower one is a female Tsonō'ɥoa holding a child between her legs; the upper one is the moon (Fig. 14). Fig. 15 shows another house front in Qumta'spē (Hope Island). The owner belongs to another gens in the traditions of which the thunder-bird Kunkunqulikya plays a great part. He is squatting over the door. To the right and to the left of the door we see another representation of Kyā'loyaɥamē, to whose gens the mother of the owner belonged. Figs. 16 and 17 are from the house of Ɥalaite, a



PAINTING ON FRONT OF HOUSE OF THE GENS KYĀ'LOYAĸAMĒ, OF THE TLATLASIĸOALA TRIBE, AT QUMTÁSPĒ, HOPE ISLAND. (Page 208.)

chief of the Naχomkilis, who belongs to the χanikila gens. χanikila is "the great transformer" of all these tribes. He is the son of the deity, and descended from heaven in the shape of an eagle. (χanikila means "he with spreadout wings.") Therefore the gens has an eagle for its emblem. The man on whom the eagle rests is Bebekumlisila, one of the figures that χanikila put up in his house. I was unable to learn the meaning of the other upright (Fig. 17). The name of the kneeling man on it is Silaī'oqa. The upper being was described as "the same as a bear," but it is evidently a sea animal.

In the model No. 130414 of the catalogue of the National Museum the men who carry the beams (Figs. 7, 8, 9) represent the slaves of one of the ancestors of the gens. The open mouth indicates that they speak for the chief, as it is considered beneath a chief's dignity to speak to the common people. The figure carrying the beam on its left shoulder is standing on a bear's head (Fig. 18). The animal, by which the other figure in the rear of the house is supported, is probably the wolf (Fig. 7). The meaning of the figure that is inclosed in the upright is unknown to me (Fig. 9). I have seen the same figure in the village of the Tlatlasiχoala, at Qumta'spē (on Hope Island), but could not learn anything about it. Neither can I say with any certainty to which gens the house belongs, as there is no painting on the front.

From these remarks it will be clear that every single carving in the houses of these tribes has some connection with the traditions of the gentes. The Indians of the present time make various combinations of the emblems of the gentes of both parents of the house-owner, and this is the reason for the great variety of forms. Besides this, legends referring to certain ancestors are illustrated in the emblems, and thus it happens that seemingly the ancient styles are not strictly adhered to.

It remains to explain several of the figures frequently occurring in these carvings. One of the most frequent carvings is the slave of the chief who is talking to the people. We saw him on the uprights of the model, on the post of Sentlaē (Figs. 7, 10), and in Fig. 18 he is standing on the gable of a house. The omitted statue in Fig. 6 and Fig. 19 belong to a similar class; the latter represents a man by the name of Kiē'χiɔ, who holds a wolf in his hands. The back of the wolf's tail shows a human face. The hind legs of the wolf are seen under the legs of a man who sits on an animal, the meaning of which I do not know, as the head is half buried in the ground, but probably it represents a bear. These two figures are hollowed out in the back, so that a man can stand behind them and speak through their open mouth, which acts as a speaking tube. The men represent slaves of an ancestor, and when the chief is speaking through the mouth at certain festivals it is supposed that the slave is speaking.

In many of the figures we see the famous copper plates (tlā'χoa), one of which is seen between Figs. 7 and 8. They are found painted on the breasts of the men in the model, they form the lower part of the post of

March 12, 1889.

Sentlaē, and the same figure is on the body of Fig. 18. These plates are highly valued, and every tribe has another tradition referring to their fabulous origin. One of these traditions has been told above. The plates are made of native copper, which is found by the Tlingit on the upper Yukon. Each plate has its own name. It is kept in a separate house into which women are not allowed to enter. They are clothed and fed regularly. The value of a plate becomes the larger the more frequently it has been given away as a present. The T-shaped stronger part is considered the more valuable. If a chief has been offended he breaks a copper and gives the parts away. Then his adversary has to do the same, or else a stain of dishonor would rest upon him. Most of the coppers are graved and painted so as to show one of the numerous emblems of these tribes. The lower field of the uppermost copper on Sentlaē's post (Fig. 10) shows four starfish; the upper one the head of the wolf. In the upper field of the second copper is the bear, while in the lower one there are four starfish. In the lower ones nothing but an eye and mouth can be distinguished; but it is evident that they are intended to represent the same thing as the second copper.

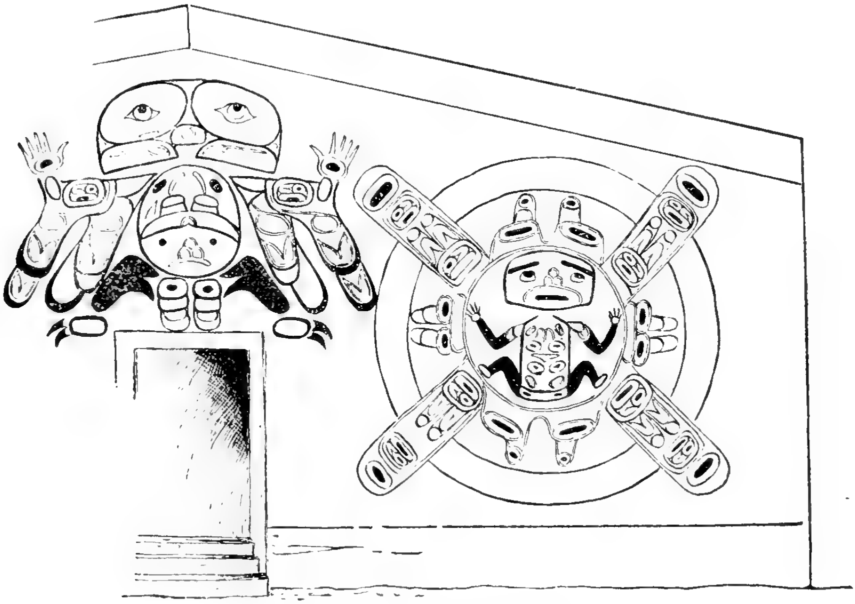
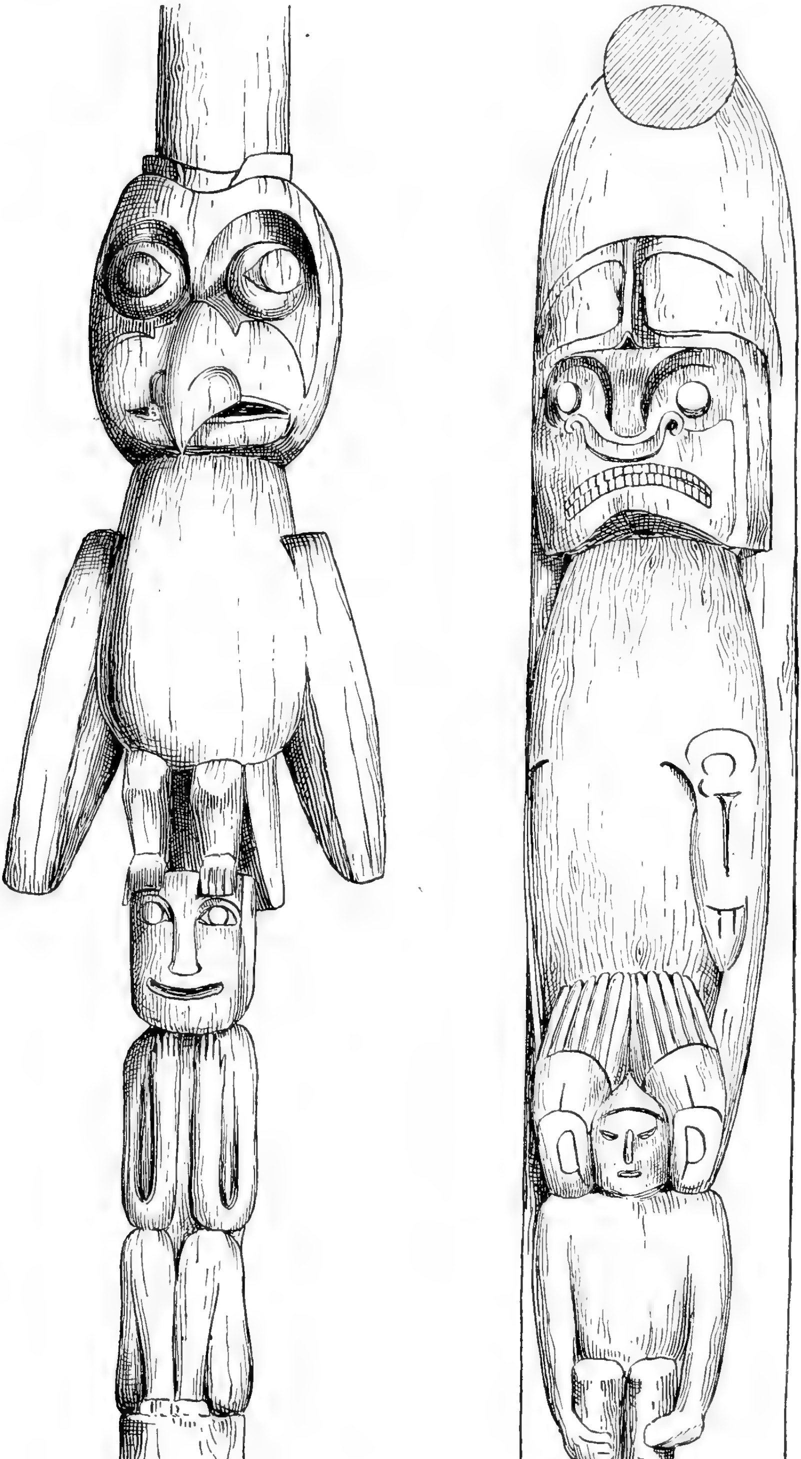


Fig. 15. House front in Qumta′spō.

Another figure that is of frequent occurrence is the Tsonō′qoa. It is the lowest figure in the post (Figs. 13, 14). Beside this the Tsonō′qoa appears in the form of masks, rattles, etc., in numerous carvings. This being is known to the Çatlōltq, who evidently borrowed the tradition from the Kwakiutl, to all tribes of Kwakiutl lineage and to the Bilqula. The latter call it Snenē′iq. One of the principal legends of the Tsonō′qoa is that she—for it is generally a woman—came with a basket on her back into the villages and put all the children into it. Then a little



FIGS. 16, 17. Uprights in the house of the Gens Ꝁanikila in Qumtā'spē.

girl cut a slit in the bottom of the basket, and thus all escaped. I was told that this is the meaning of Fig. 14. The huge eye-holes are characteristic of Tsonō′ɋoa, and, in case it is a woman, her enormous breasts.

On the house front (Fig. 15) we find the thunder-bird. He is an important figure in many traditions and therefore appears in numerous combinations. The house front (Pl. XL) shows how Kunkunqulikya tried to lift the whale. The legend says that he had stolen the son of the raven, who, in order to recover him, carved a whale out of a huge cedar that he covered with a coating of gum. Then he let

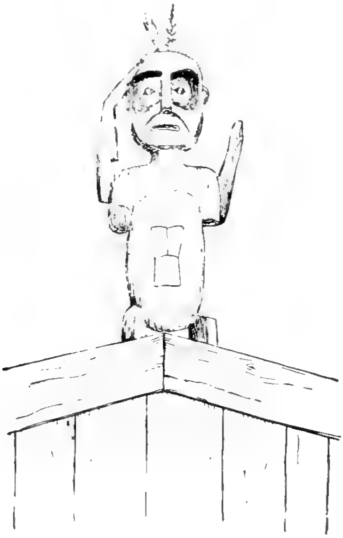


FIG. 18. A Chief's slave talking to the people. Alert Bay: about 4′ high.

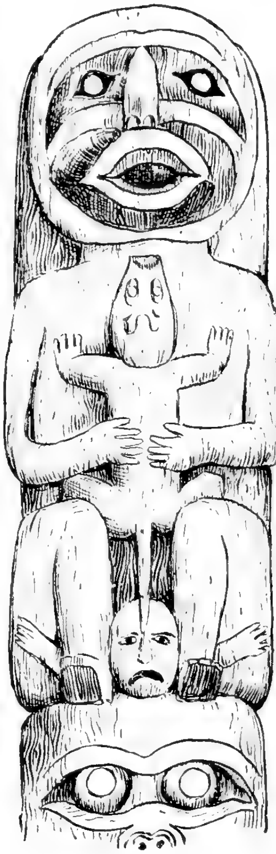


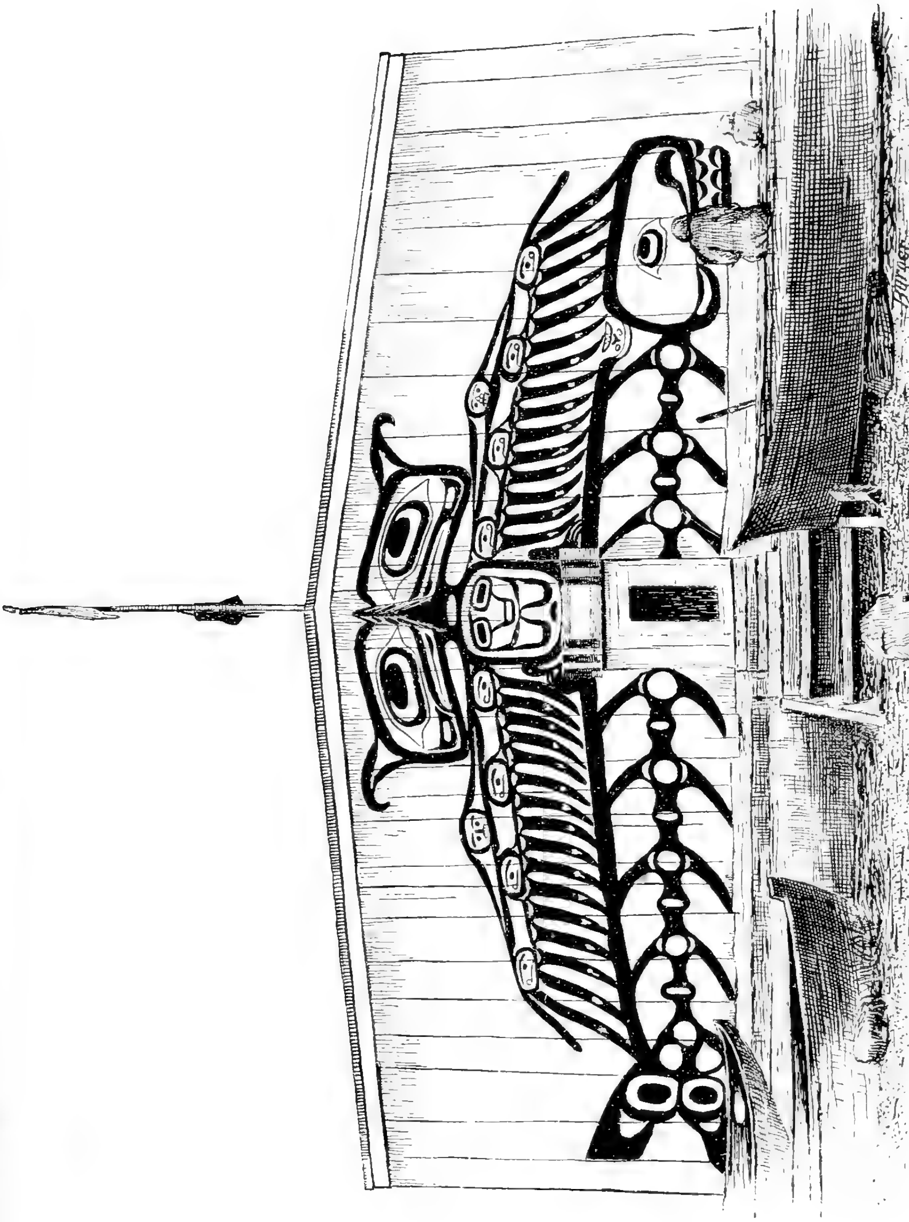
FIG. 19. Statue in a house at Qumtá′spē (Hope Island): about 7′ high.

all kinds of animals go into the whale, and they went to the land of the thunder-bird. When the bird saw the whale he sent out his youngest son to catch it. He was unable to lift it. He stuck to the gum and the animals killed him. In this way the whole family was slaughtered.

The same design is found on a house front in Nuqalky. The Bilqula, who live there, have the same tales of the thunder-bird; they call it Saiōtl.

Another figure that is frequently represented in the carvings of these tribes is the Sisiutl, the fabulous double-headed snake that can adopt the shape of any fish. The traditions referring to this being are particularly important among the ɋauitcin and their neighbors, but all tribes from Puget Sound to Dean Inlet have traditions referring to it.

I mentioned above that the style of houses discussed here does not extend farther south than Comox, on Vancouver Island. The tribe that lives there, the Çatlōlt, belong to the Coast Salish, but they have inter-



THE THUNDER-BIRD TRYING TO LIFT A WHALE.—FRONT OF A HOUSE OF THE GENS GI'GILKUM, AT ALERT BAY. (Page 213.)

married with a tribe of Kwakiutl lineage and thus adopted many of the mythical figures of the latter. Their own characteristic design (Fig. 21)

FIG. 20. Post in a house at Comox, showing Qā′eqoē.

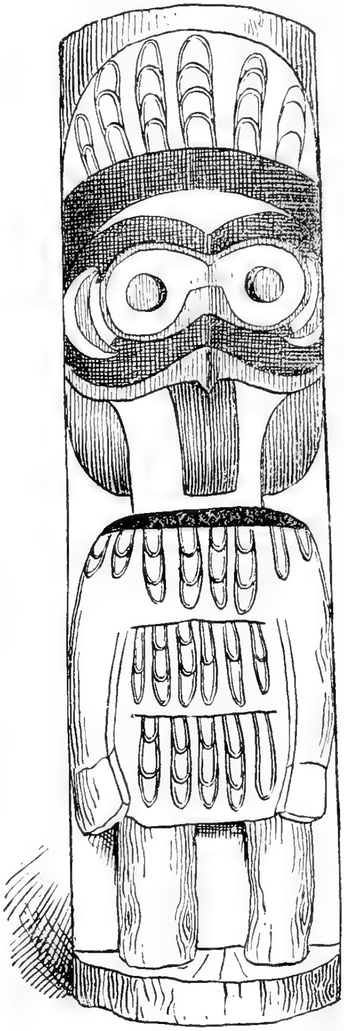


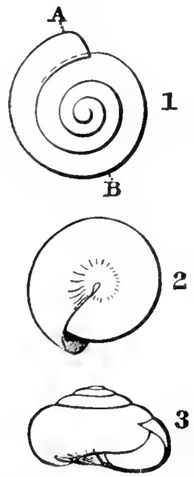
FIG. 21. Base of Fig. 20 enlarged. Qā eqoē.

is the Qā′eqoē, a bird-like being that descended from heaven and became the ancestor of the Çatlōlt.

DESCRIPTION OF A NEW SPECIES OF HYALINA.

BY WM. H. DALL.

Dr. V. Sterki, of New Philadelphia, Ohio, has of late years been giving special attention to the minute forms of Pulmonata, *Vertigo*, *Pupilla*, *Hyalina*, etc. In 1886 he collected a small *Zonites*, of the section *Hyalina* or *Conulus*, which, being submitted to several naturalists, appeared to be a new species, although of remarkably small size. In 1887 a few more specimens were obtained, which he has submitted to me with the request that I describe them.



FIGS. 1 to 3. *Hyalina sterkii*, n. s.

H. testa parva, convexiusculo depressa, nitida, striis incrementalibus inconspicuis; sutura vix impressa, anfr. IV, rotundati, ultimus circa umbilicus imperforatus excavatus; apertura depressa, vix obliqua, ampla, lunaris; perist. simplex, acutum, margine dextro columellari vix reflexiusculo. Diam. maj., 1.1^{mm}.; alt. 0.52^{mm}.

Shell minute, thin, yellowish translucent, brilliant, lines of growth hardly noticeable, spire depressed, four-whorled; whorls rounded, base flattened, somewhat excavated about the center, which is imperforate; aperture wide, hardly oblique, not very high, semilunate, sharp edged, the upper part of the columella slightly reflected; upper surface of the whorls roundish, though the spire as a whole is depressed. Max. diameter 0.044 inch (line A—B, Fig. 1); alt. 0.026 inch.

This little shell is clearly not the young of a *Pupilla* or of any of our other small *Zonites*. It is certainly the smallest American species. *H. parvula* Rong, from Cape Verde Islands, has a little less diameter, but is higher in the spire. *H. pygmæa* and *H. minutissima* Lea are decidedly larger, beside belonging to a different group. It is probably one of the smallest species known, and remarkable for its imperforate umbilicus.

It was collected on a grassy slope, inclining to the northward, and covered with grass, moss, and small bushes, and so far has not been found anywhere else. Its permanent place in the system will, of course, be determined by an examination of the soft parts, which remains to be made.

Proceedings U. S. National Museum, vol. xi, 1888.

OBSERVATIONS UPON THE OSTEOLOGY OF THE NORTH AMERICAN ANSERES.

BY DR. R. W. SHUFELDT, U. S. ARMY.

This well-circumscribed order or group agrees with Huxley's *Chenomorphæ*, and contains the Mergansers, Ducks, Geese, and Swans.

For some time past I have been accumulating the material for a memoir upon the osteology of the entire group of lamellirostral birds of this country. I still lack, however, quite a number of important forms, which may take more or less time to secure. So that the present memoir must not be considered more than an introduction to the subject, though here it has the claim of introducing a number of drawings of those forms, which can be compared with advantage with other species which I did not happen to have in my possession at the time this was written.

Much of the anatomy of the anserine birds is known to us already, but that further elucidation in this direction is very desirable I hardly think any one will question. Garrod gave the subject no little attention, though he confined himself principally to the condition of the carotids, the presence or absence of certain muscles, and the form of the osseous portions of the air-passages in a number of the rarer types of Ducks. As I have just said, Huxley, in his famous essay upon the Classification of Birds, created a separate group—the *Chenomorphæ*—to contain, with a few related forms, the *Anatidæ*, a division based upon anatomical characters so far as they were known at the time.

Coues, in 1884, in the second edition of his Key, availing himself of all that was known up to that period which could be successfully utilized in classification, awards the anserine birds the order *Lamellirostres*, dividing it into the suborder *Odontoglossæ* for the single family of the Flamingoes, and the suborder *Anseres* to hold the Swans, Geese, River and Sea Ducks, and the Mergansers, these latter each having a separate subfamily created for it, to wit, The *Cygninæ*, the *Anserinæ*, the *Anatinæ*, the *Fuligulinæ*, and the *Merginæ*, respectively. Collectively these subfamilies constitute the family *Anatidæ* of this author. Some few unimportant changes were made in the American Ornithologists' Union Check-List, but this classification remains substantially the same.

Even by their external characters, the Swans, Geese, and Ducks, and the more modified Mergansers form a very sharply-defined group of birds, and morphology has made quite clear to us the probable relation the Flamingoes bear to them. So that it is not very likely that further investigations will materially disturb the classification now adopted and presented in the Check-List of the American Ornithologists'

Union. In fact, every advance anatomy has made in that direction seems to have been attended by the one result, and that to assure us of the soundness of the arrangement in question.

Instead of this being a signal, however, for the anatomist to cast his eyes from this line of work and slacken the activity of his scalpel in what he may think profitless employment, it all the more devolves upon him to push his researches to a point nothing short of a perfect knowledge of the structure of these forms. That we have not arrived at any such state of perfection I could easily point out. As I have elsewhere shown, even so profound an anatomist as Huxley, from lack of material and established data, may occasionally fail to properly define an important characteristic, as he did in describing the sternum of these very *Chenomorphæ* (P. Z. S., 1867). Again, it is but recently that Dr. Baur, of Yale College, claims to have discovered an additional joint in the last digit or the middle finger of the embryo of the common Duck, a structure which is said to be visible at about the time of hatching.

I have never had reason to change my opinion as to the value, the incalculable value, of a complete knowledge of the morphology of those living forms best known to us. With such a knowledge of the structure of the anserine fowl we are far better prepared to push our investigations, with infinitely greater chances of assured results into the structure of allied groups than if we were not quite certain of each and every detail in the organization of these known forms.

The *Anseres* are well represented in the United States, and abundant opportunity is afforded to study their structure.

Further work is much needed in this line upon the air passages of the entire group, the generative organs, and other special parts.

The *Merginæ* constitute the first subfamily under the *Anatidæ*, and it has been awarded two genera in our fauna, viz, the genus *Merganser* of Brisson, containing the Mergansers, and the genus *Lophodytes* of Reichenbach, created to contain the Hooded Merganser (*L. cucullatus*).

The Mergansers present us with some very interesting points in their osteology, and the majority of these can be studied in the skeleton of *Mergus serrator*, a very good specimen of which bird I have now at hand. I am indebted to the Smithsonian Institution for the loan of it (No. 16626 of the Smithsonian Institution collection), and will now describe its skeleton.

OBSERVATIONS UPON THE OSTEOLOGY OF MERGUS SERRATOR.

Of the skull.—We find in this bird that the lamellæ of the bill develop tooth-like serrations for the entire length of both mandibles. These pseudo teeth, however, make no impression whatever upon the osseous base of the bill, and in a well-prepared skeleton we would never suspect their existence. Upon lateral view of this skull (Fig. 1) we see that the superior mandible curves slightly upwards as we proceed toward its

apex; the lower margin is sharp, and above it is convex, except in the cranio-facial region and somewhat beyond, where it is depressed.

A *nasal* is a large, broad bone; its anterior margin is rounded as in other holorhinal birds. The nostril is elliptical and placed horizontally, and the sutural traces of the bones that surround it entirely obliterated. A *lacrymal* bone is triangular in form, its apex below terminating in a spindle-form process, which is curved somewhat outward. Along its superior border it anchyloses with the frontal and nasal, the sutural trace being quite distinct in the adult skull. Not so, however, in most of the Ducks and Geese.

All anserine birds seem to possess a slender jugal bar; in the case of the Red-breasted Merganser, its distal end turns abruptly upward to make its articulation with the quadrate.

This latter bone has its orbital process widely bifid; its mastoidal head is single and roundly convex.

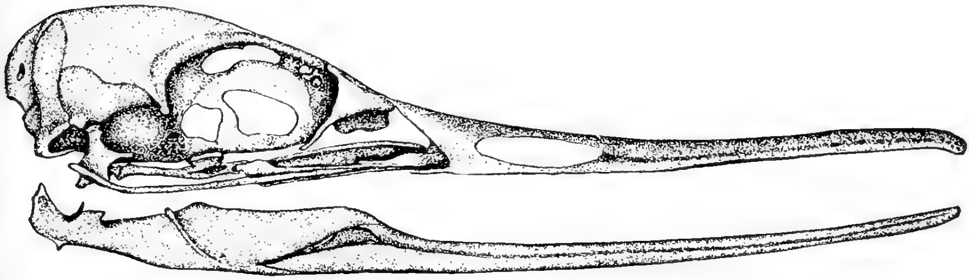


FIG. 1. Skull of *Mergus serrator*; right lateral view; life size. By the author, from specimen 16626, Smithsonian collection.

The facets at its mandibular foot are two in number, placed obliquely. They differ considerably in form and position from the same parts as seen in a specimen of a Brant before me.

The sphenotic process is prominent and gradually curves downward along its extent. In most Ducks it points downward and forward.

We find the hinder moiety of the superior orbital periphery rounded off for the lodgment of the nasal gland. The extent to which this is carried varies in the different species of anserine fowl.

About the center of the interorbital septum there occurs a large fenestra, and the foramina for the exit of the first and second pair of nerves are much larger than necessary for this purpose alone.

The pars plana is a very thin, curved sheet of bone, which supports in front a crumpled mass of equally attenuated osseous tissue. This latter projects into the upper space of the rhinal chamber, and no doubt plays the part of a turbinated bone. Neither of these outgrowths come in contact with the inner aspect of the lachrymal bone of the same side.

The lower margin of the rostrum is straight, rising gently upward as it is projected forward, being sharp below along its anterior moiety.

Anteriorly the ethmoid has an elongo cordate outline, the base of the figure abutting against the under side of the cranio-facial region.

Viewing this skull from beneath we notice a long, narrow cleft in front of the maxillo palatines and bounded on either side by a dentary process of the premaxillary. This cleft is deepest behind and gradually becomes shallower as it proceeds to the front, where it disappears just behind the rounded mandibular apex.

The *maxillo-palatines* are thin, horizontal plates that are in contact for their anterior halves in the median line, but diverge as rounded, distinct processes for their posterior moieties. These processes project into the wide interpalatine cleft, but do not come in contact either with the palatine bones nor with the *vomer*. This latter is a long, thin plate of bone that is grasped by the small ascending processes of the palatines behind to anchylos with them, while above it is finished off with a rib-like margin which is produced beyond the plate in front as a long spiculiform process, with its apex resting upon the middle of the maxillo-palatine median suture.

Each *palatine* body is a narrow lamina of bone, the anterior end of it dilating somewhat before being inserted between and fused with the other elements in front.

These palatines only meet each other, and that only in a point, behind their common seizure of the hinder end of the vomer. Nor do they come in contact with the under border of the rostrum, as they are prevented from doing that by the sessile, though large and elliptical, basipterygoid facets found upon the latter.

Their heads are separated behind by quite an interval, and each one makes a peculiar combination joint with the corresponding head of the pterygoid, which develops the reverse articulation for it.

Immediately posterior to this a *pterygoid* supports also a sessile elliptical facet of precisely the same character as the one referred to above as occurring on the rostrum, the two coming in contact to form a perfect sliding joint, with smooth and plane surfaces opposed to each other.

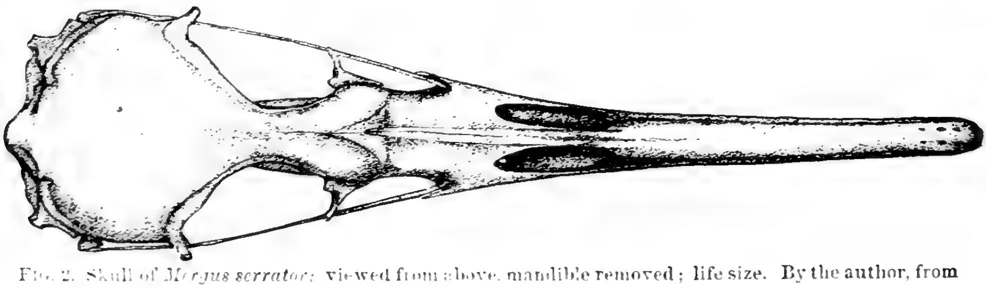


FIG. 2. Skull of *Mergus serrator;* viewed from above, mandible removed; life size. By the author, from specimen 10626, Smithsonian collection.

Posterior to this articulation a pterygoid is somewhat compressed from above downward, and curves gracefully outward to cover with its cup like hinder end the spheroidal facet offered to it on the part of the corresponding quadrate.

The basi-temporal region is broad and smooth, and a spine-like process at its apex fails to shut out from view the double orifice leading to the Eustachian tubes.

We find the major portion of the crotaphyte fossa upon the lateral aspect of the skull. Still it may be seen also from a posterior view, where the two depressions approach each other, but are separated by a large dome-like, supra-occipital prominence.

This latter is usually pierced by an irregular foramen on either side, which is quite characteristic but not always present in the Ducks and Geese. In a specimen of *Branta canadensis hutchinsii* before me a large one occurs only on the left side of the prominence.

Mergus has a large foramen magnum which faces almost directly backward. The occipital condyle at its lower margin is of a reniform outline with the notch above.

In the *mandible* the symphysis is short, and this bone, when seen from a superior aspect, is of an acute V-shape form.

The anterior two thirds of either ramus is narrow, tapering somewhat to the front, with both upper and lower borders rounded. On the outer surface a deep, median, and longitudinal groove of hair-like proportion is drawn along its entire length.

The hinder third is much wider, nearly double the width, and, instead of being thick like the fore part of the bone, is a vertical lamelliform plate. Its border is sharp above, while below it is rounded, being in the same line with the inferior border of the anterior two-thirds.

The ramal fenestra is nearly or quite closed in by the surrounding elements; a long, oblique slit marks its site. A curved projection is developed on the outer aspect of this part of the bone: that above apparently takes the place of part of the coronoid process.

Each mandibular facet presents two oblique grooves upon an area contracted to the minimum extent that would accommodate the mandibular foot of the quadrate that articulates with it.

Behind, either angle is produced backwards as a recurved and vertical lamina of bone, to the inner side of which we find the circular entrance to a deep conical pocket.

Mergus serrator has an enormous bilobed tracheal tympanum at the pulmonic bifurcation of its windpipe. These interesting structures vary much in form and size in the different species of birds that possess them, and would well repay a general comparison.

Of the vertebral column and ribs.—This Merganser has sixty-one vertebræ in its spinal column; the first pair of free ribs occurring on the sixteenth; then follow five others that have ribs connecting with the sternum by costal ribs; seventeen anchylos to form a sacrum for the pelvic bones; and, finally, we find seven free caudal vertebræ besides a pygostyle. All these segments are freely movable upon one another, except those in the sacrum. In *Mergus* the odontoid process of the

second vertebra does not perforate the cup of the atlas from behind, but both these segments, in common with many Ducks, present the interesting condition of having the lateral vertebral canals at the outer sides of their centra, for the protection of the vessels that pass through them. This canal is a very prominent feature through all of these cervical vertebræ through the twelfth; in the first five or six it has a fenestra in its lateral wall on either side. With the exception of the last few vertebræ in which it occurs, it extends nearly the full length of the centra, while its inferior wall includes the greater part of the parial parapophyses, and these latter being rather widely separated, we have as a result a broad area at the under side of all of these vertebræ where this construction obtains.

The hyapophysial canal is found in the sixth to the twelfth, inclusive, but in none of these does it close in entirely, though the processes approach each other very near in the last-mentioned vertebra.

Axis vertebra has a prominent hyapophysis, but it is missing in the third vertebra, and this process does not make its appearance again until we find it as a conspicuous median plate in the thirteenth. In the fourteenth it is smaller, and although still in the vertical plane, evidently moved slightly to the left of the median line. This last condition is more pronounced in the fifteenth, while in the sixteenth, where it still possesses considerable size, it is carried so far to the left as to be nearly in the same plane with the side of the vertebra, though it still remains vertical. Sixteenth vertebra also has lateral hyapophysial cornua, which makes this peculiar shifting of its mid-process all the more striking. I am unable to say at present whether this is a constant condition of affairs or not. The dorsal series also have hyapophysial processes; these are at first short, with spreading cornua, to gradually become longer and lose their terminal bifurcation, and again grow shorter, to finally disappear on the first sacral, or dorso-lumbar.

Axis has a thick and heavy neural spine. In the following six or seven segments this gradually becomes longer, lower, and thinner, to be absent entirely in the tenth cervical vertebra. In the fourteenth it re-appears, and from it, backward, it gradually assumes the broad, oblong plate which is perfected in the dorsal series. The vertebræ of this latter region are restricted in their movements upon one another by the many interlacing tendinal and metapophysial spiculæ among them.

In the cervical region the neural canal is cylindrical in form, and owing to the fact that neither the pre- or postzygapophysial facets are upon spreading limbs, in its anterior division this tube is wonderfully well protected, its walls being nearly continuous from one vertebra to the next. This condition does not obtain in the latter half of the cervical region, however, where the prolongation of the aforesaid apophyses lend to the dorsal aspects of the vertebræ, when viewed from above, that familiar capital-letter-of-X appearance, with the extremities of the lines alternately articulating above and below.

This disappears again in the dorsal series, where they are closely interlocked with each other, and the neural tube once more becomes continuous. For the rest we find that the "heterocœlous" plan of articulation prevails among these vertebræ thus far described; that the centra are much compressed laterally in the dorsal region, where also the transverse processes are unusually wide and some of their spiculiform interlacements more than commonly broad. With the exception of the atlas they are all pneumatic.

The pair of free ribs that are attached to the sixteenth vertebra are long and pointed, with free extremities. They do not, however, bear epipleural appendages.

Nothing peculiar marks the ribs of the dorsal series nor the hæmapophyses that connect them with the sternum. The epipleural appendages are large and all are closely, though freely, articulated with the posterior borders of their ribs.

The first pair of sacral ribs are like the dorsal ones, except they have no epipleural appendages. The last two sacral pair, however, anchylos with the pelvis, and their hæmapophyses do not reach the sternum.

Of the sternum (Figs. 3 and 4).—*Mergus* has an interesting form of this bone, and it differs in a number of points from the sterna of its supposed nearest allies among the Ducks. The body is of an oblong outline and moderately well concaved above. Right over the anterior border in the median line there is a single semi-globular pit, but there appears to be no pneumatic foramina of any size at its bottom.

The costal processes are large, prominent, and quadrate plates. They extend behind the first hæmapophysial facet. These latter articulations are six in number, and the lateral borders behind them are sharp, curving at first outward, before they extend backward, to the xiphoidal margin.

Upon the convex, pectoral aspect of the bone we are to notice the principal muscular lines. These extend directly backward, one on either side, from the lip of bone that overarches the outer end of the coracoidal groove, to pass along the inner side of the vacuities behind, where they become very faintly marked.

A transverse straight line limits the xiphoidal extremity, and engrafted upon this in its middle we find a distinct convex prolongation of no great size, its base being rather less than one-third of the border upon which it occurs.

Just over this latter, in the apertures of the postero-external angles of the bones, we find on either side a large, oval fenestra.

A sternum of this shape, differing as it does in this particular from the notched style of the bone among most of the Geese and Ducks (for it is the same as we find it in *Glaucionetta*), forms an exception to the character laid down by Huxley for his *Chenomorphæ*, which includes the subfamily to which *Mergus* belongs. (Fig. 3.)

The extensive coracoidal beds of the anterior border are separated by a pit in the median line, and not a vestige of such a thing as the manubriam is to be seen.

From the pit just mentioned to the far-projecting carinal angle a straight osseous welt is raised, above which the anterior margin is convex and sharp.

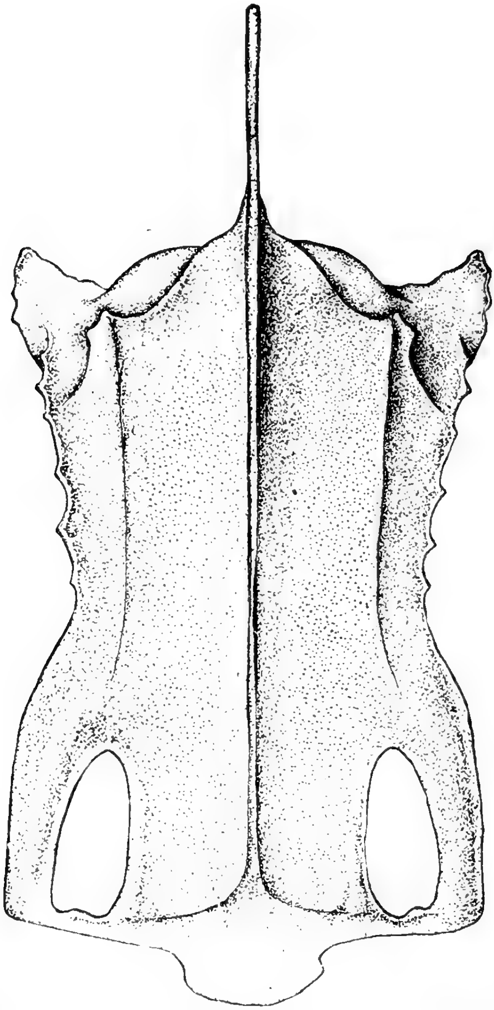


FIG. 3. Sternum of *Mergus serrator*: pectoral aspect: life size. By the author, from specimen 16626, Smithsonian collection.

The keel itself is low and extends clear back to the hinder margin of the bone proper; its inferior border is thickened and gently convex throughout its extent.

As a very good example of the appearance of the sternum among the Ducks I present a drawing of the pectoral view of the bone chosen from the American Eider (*S. dresseri*, Fig. 13). In this form the profoundly two-notched hinder portion is well shown, and here, too, we observe that the anterior part of the keel does not project as in *Mergus*, though it is not an uncommon thing to find it so even among true Ducks.

Of the shoulder girdle (Fig. 5).—Most Ducks, and I believe all the Mergansers, have a non-pneumatic pectoral arch. It is the case in our present subject, and in a number of the former at my hand.

The *furcula* typifies the broad U-arch in *Mergus*, where the curve is continuous and unchecked by the presence of a hypocleidium.

The bone is, as a whole, slightly curved backward, so each limb presents a convexity to the front; these become broader and laterally compressed as we pass in the direction of their free extremities.

Either head very gradually tapers off to a point, and these produced ends ride over the scapulæ when the arch is articulated.

Projecting from their upper borders we find a single distinct and vertical process of bone that is quite characteristic. In the Eider this is in cartilage, but otherwise the fourchette is formed in this Duck very much the same as in the Merganser. (Fig. 14.)

In a *coracoid* we find the summit of the bone much produced above its articulation with the scapula, and compressed in the same plane with the shaft below it in such a manner that when articulated with the sternum the front of the bone is directed forward and outward.

The sternal extremity of the bone is very much expanded, and it also is found in the same plane with the general compression of the shaft.

Behind it is scarred by muscular lines, and shows a large luniform facet for the groove on the sternum.

The scapular process of the coracoid is to a great extent aborted; its superior margin being insufficient to accommodate the entire width of the scapula.

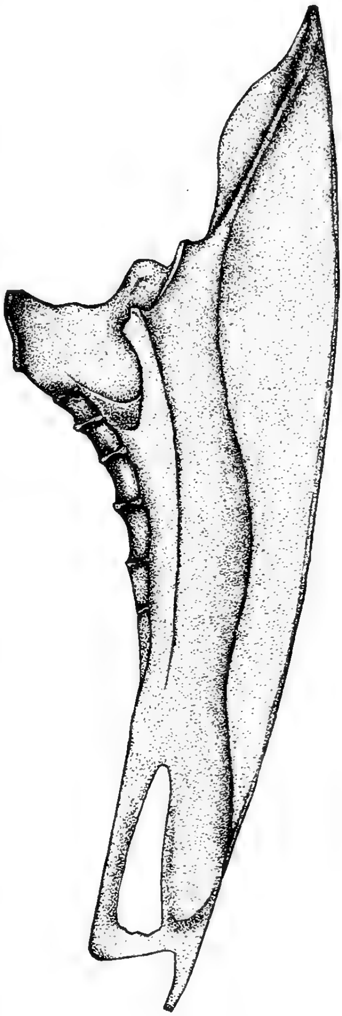


FIG. 4. Sternum of *Mergus serrator;* right lateral view; life size. By the author, from specimen 16626, Smithsonian collection.

Nothing of importance distinguishes the glenoid cavity, it being formed, as in most birds, in the proportion of one-third on the part of the scapula and the remainder by the bone under consideration.

The *scapula* is much arched, and nearly of an equal width the entire length of its blade, its apex being rounded off. We find the bone considerably compressed in the vertical direction throughout, and the length of the chord measured between its extremities less than the length of the coracoid.

Of the pelvis and caudal vertebræ.—In order to better illustrate the fact that the pelvis in the Mergansers is constructed upon the same plan as that bone in other anserine birds, I have contrasted it, in Figs. 7 and 8, with the pelvis of the American Eider Duck. It will be seen at a glance that all the characters present in the latter are also to be found in *Mergus*, simply somewhat modified in concordance with its life as a diver.

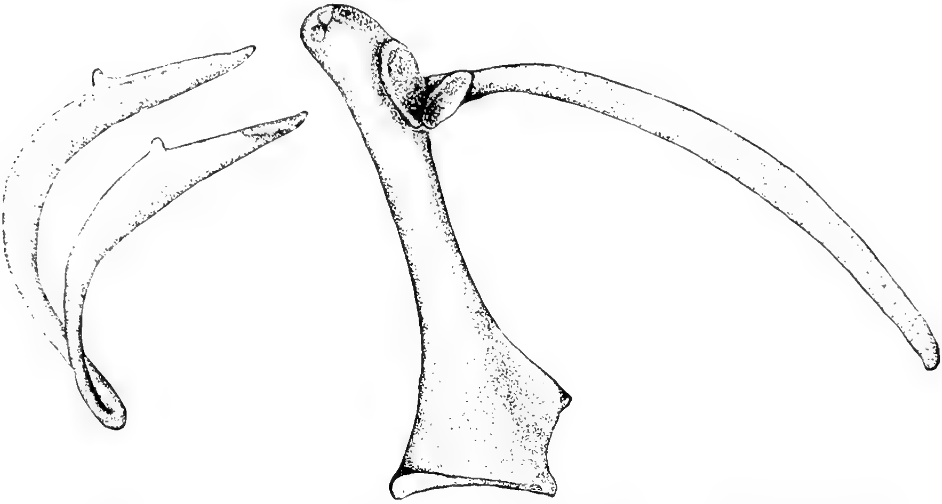


FIG. 5. Left scapula and coracoid, with furcula detached, *Mergus serrator;* life size. By the author, from specimen 16626, Smithsonian collection.

The ribs of the first three vertebræ that anchylos in the sacrum have already been described when speaking of these bones in general. Next to them we find that the three succeeding vertebræ throw out their apophyses to the pelvis and firmly anchylos therewith. After them we fall into the deep and oblong pelvic basin possessed by this bird, and the next three vertebræ send their processes directly upward. They are followed by a series of eight more that gradually approach the free caudals in form. The anterior one of these has the strongest lateral processes, but they are found to abut against the ilia on either side at a point anterior to the middle of the ischiac foramen, and not right behind the cotyloid cavities as in many other birds. The inner margins of the ilia anchylose with the outer ends of these sacro-vertebral apophyses, from the acetabula, backward, excepting the last one.

Opposite the cotyloid cavities we find the enlargement to accommodate that part of the spinal cord where the sacral plexus is thrown off; the openings for the exit of the latter are double, being placed one above the other.

Viewing this pelvis of *Mergus serrator* from above, we always find, jutting out in front, a tuft of bony spiculæ that form a part of the same system that strap the dorsal vertebræ together.

The inner margins of the ilia meet and anchylos with the top of the

common neural spine of the leading vertebræ, converting the ilio-neural grooves into canals.

Each preacetabular portion of an ilium is much shorter than its postacetabular part, and also on a very much lower level. In front its border is emarginated, transversely truncate, and somewhat serrated. The surface of the bone is concave, and for the most part looks upward and outward.

Behind the acetabulum most of the ilium is devoted to the lateral aspect of the pelvis.

Turning to this side of the bone, we notice a pro-pubis of considerable size in front of the cotyloid ring, while the post-pubic element is a long slender rod, extending directly between the under side of the obturator foramen and the postero-external angle of the ischium, with which it articulates. Beyond this, it trebles its width and curves rather abruptly toward the fellow of the opposite side. A very narrow, open strait connects the obturator foramen and the obturator space; the former being rather smaller than usual and the latter very large.

The lower margin of the ischium is concave downward and very sharp, while the posterior border of the pelvis, formed by both the ischium and ilium, is perpendicular to the long axis of the bone. It shows one or two indentations that are not to be found in the same pelvic border of the Eider.

The acetabulum is large, with its inner and outer rings nearly of the same size; an antitrochanter of moderate dimensions stands between it and the antero-superior margin of the large elliptical ischiac foramen.

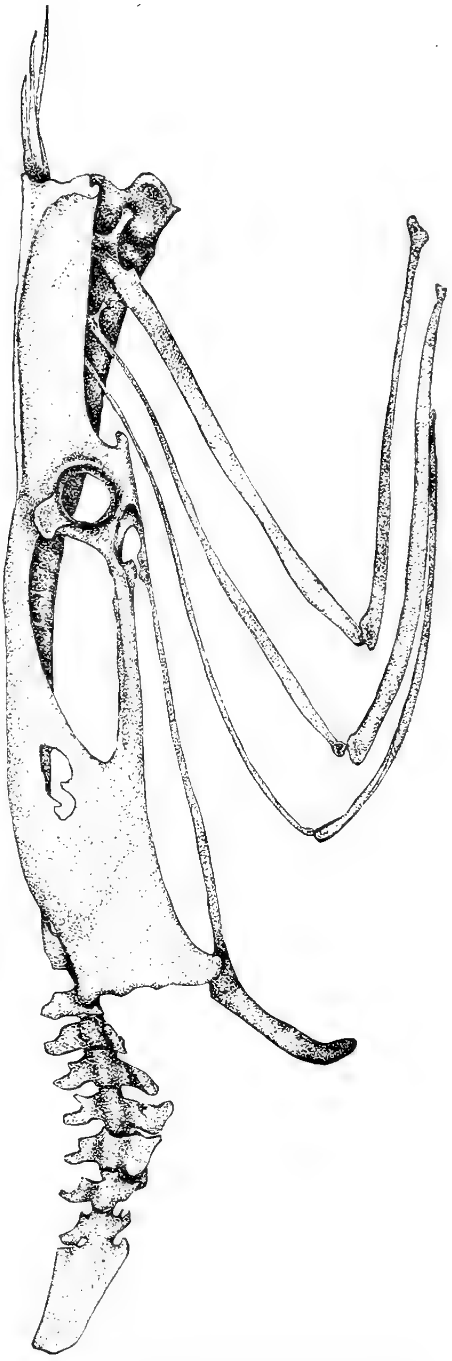


FIG. 6. Right lateral view of pelvis, caudal vertebræ, and sacral ribs of *Mergus serrator*; life size. By the author, from specimen 16626, Smithsonian collection.

Posterior to this latter aperture the ilium rises as a smooth dome

March 12, 1889.

above its own postero lateral plane and the ischium which lies below it.

In the present specimen this convexity shows a large fenestra in either ilium at its anterior part. No such vacuity exists in the Eider nor other Ducks in my possession. In some specimens the bone in the same locality is so thin that I expect it occasionally occurs in those birds also.

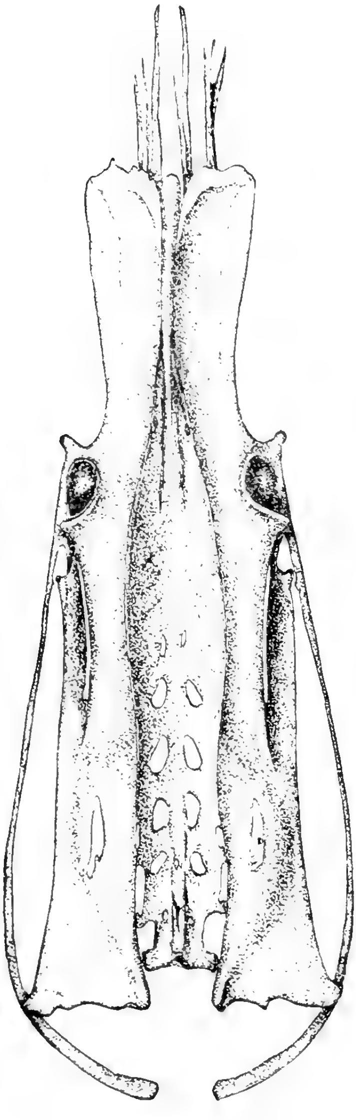


FIG. 7. Pelvis of *Mergus serrator*: viewed from above. (Specimen 16626, Smithsonian collection.)

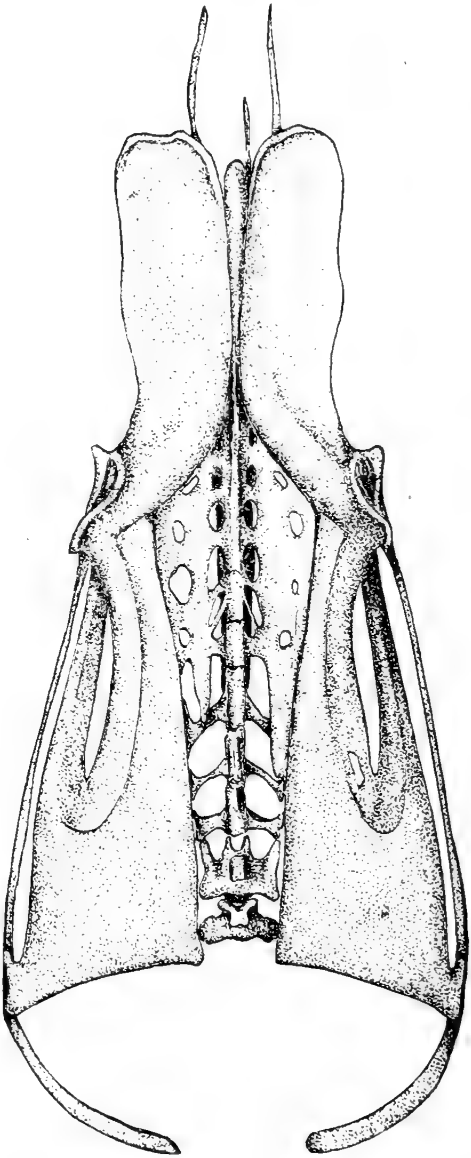


FIG. 8. Same view of pelvis of *Somateria dresseri*. (Specimen 16989, Smithsonian collection.) Both figures life size. By the author.

As already stated there are seven free *caudal vertebræ* and a pygostyle. The neural canal passes through all of the former and a short distance into the latter. Above it the neural spines are notched in front, and have an elevated, stumpy process behind.

The ends of the shortened diapophyses of the first free caudal are usually overlapped by the ilia, but in the next segment these processes are much longer, to be longer still in the third and fourth vertebræ. In the next two they again become shorter, to be entirely abortive in the ultimate one. In all they are broad and depressed.

Chevron bones are freely articulated between the centra of the last three or four vertebræ of the tail; they are bifid in front and grow gradually smaller as we proceed in that direction.

The pygostyle is here of considerable size, being an irregular quadrilateral figure, with its lower margin thickened, and all the others thin and cultrate.

Of the appendicular skeleton; pectoral limb.—When the skeleton of the upper extremity is in a position of rest alongside the body, we find that the humerus is somewhat longer than the bones of the antibrachium, and the pinion also projects beyond them behind to the full extent of the last phalanx of index digit.

The *humerus* is characterized by a broad, proximal extremity, showing an enormously deep pneumatic fossa, and a distinct trench between the ulnar crest and articular head, running beneath the latter. Its cylindrical shaft shows the usual sigmoid curves from radial and anconal views. Nothing unusual marks its distal extremity, where we find the trochlear tubercles for radius and ulna.

These latter bones are non-pneumatic, in common with the remainder of the skeleton of this limb. The shaft of the *radius* is straight, whereas it is curved in the *ulna*, the concavity occurring on the side toward the interosseous space.

The cylindrical shaft of this latter bone is faintly marked by a double row of papillæ for the secondaries.

In the *carpus* we find the two usual segments of forms common to the majority of the class.

In the pinion the bones are all remarkably well developed. *Carpometacarpus* has its main shaft straight and of a caliber intermediate between those of the antibrachium, or larger than the shaft of radius and smaller than the shaft of ulna. First metacarpal is short and anchylosed in the usual manner to shaft of index. The long trihedral pollex phalanx bears a distal joint, which is also the case with the second phalanx of index digit.

All the bones of the *pelvic extremity* are non-pneumatic, though the principal long ones have sizable medullary cavities.

The *femur* has a very large head, which rises somewhat above the broad articular summit of the shaft, notwithstanding its crown is considerably excavated for the ligamentum teres. The axis of its neck makes an angle with the axis of the shaft.

Trochanter major is suppressed above, while on the anterior aspect its thin edge partly surrounds a sort of fossa, where in other birds the pneumatic orifices occur. Its shaft is rather compressed from side to

side and bent very slightly in the anterior direction. About its middle, on the posterior aspect, there is a prominent muscular tuberosity, and other lines or scars for muscular insertion are evident. Of the condyles the outer one is the lower, and it is profoundly cleft for the fibular head.

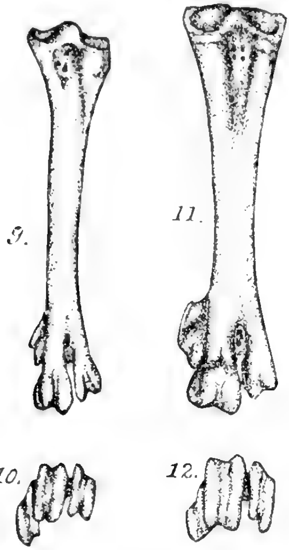


Fig. 9. Left tarso-metatarsus; anterior view, *Mergus serrator*. (Specimen 16626, Smithsonian collection.)

Fig. 10. Same bone seen from below.

Fig. 11. Corresponding bone from *Somateria dresseri*. (Specimen 16989, Smithsonian collection.)

Fig. 12. Same bone as Fig. 11, seen from below. All these figures life size. Drawn by the author from the specimens.

The popliteal depression is represented by a characteristic conical pocket just above the internal condyle on the posterior aspect. The rotular channel in front is also deep, but does not extend up the shaft a great distance.

From this same specimen I have illustrated the patella of this Merganser elsewhere (Proc. U. S. Nat. Mus., Vol. VII). It is seen to consist of two segments, with an oblique groove in the cartilage connecting them. Through this the tendon of the ambiens muscle passes.

Tibio-tarsus has a straight shaft that, unlike the femur above it, is somewhat compressed from before backward. At its proximal extremity we find a cnemial process reared above its articular surface for the femur. Prominent cnemial ridges occupy the anterior aspect of this, as usual. Of these the procnemial ridge is the higher and extends the lower on the inner side of the shaft.

The distal end of tibio-tarsus presents nothing peculiar. The groove anteriorly is deep, and the osseous bridge that spans it is thrown directly across. The external condyle is the broader in front, and its outer aspect is in the same plane with the side of the shaft, while the corresponding surface of the inner condyle lies beyond the plane of the shaft, for its own side.

Behind, these condyles still continue to be parallel to each other, but separated by an intercondyloid concavity that from its shallowness is scarcely worthy of the name, while the condyles themselves really merge into a broad, articular surface in this locality.

The *fibula*, when articulated, is found to rise above the summit of the tibia and project beyond it posteriorly. Its head is compressed from side to side, which gives it a very short, transverse diameter, while its antero-posterior one is fully three times as long. The articulation with the fibular ridge on the side of the tibio tarsal shaft exceeds in length that portion of the bone that projects above it, and equals in length the slender portion that is found below. The connection between the bones along this ridge is of a ligamentous nature, and the distal fibular

end seems to be attached pretty much in the same way to the side of the tibial shaft. This latter articulation occurs at a point about the unction of middle and lower thirds of the shaft of the larger leg bone.

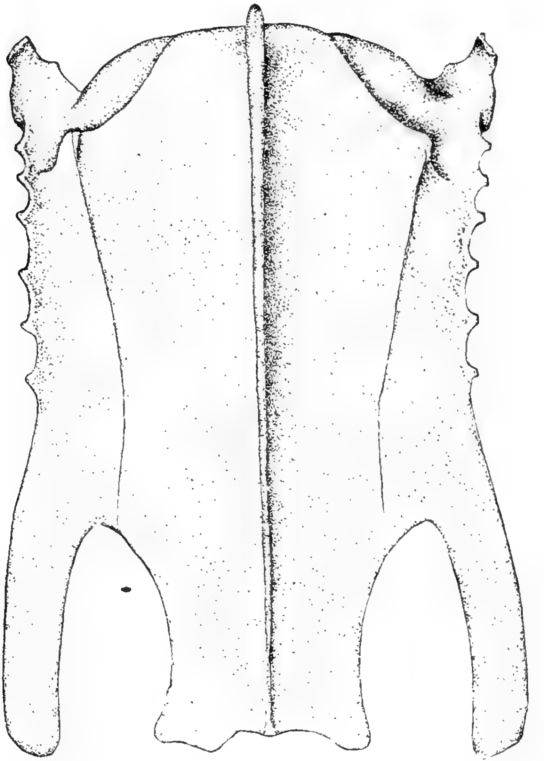


FIG. 13. Sternum of *Somateria dresseri*; pectoral aspect. (Specimen 16989, Smithsonian collection.) By the author. Life size.

With the exception of its proximal fourth, the *tarso-metatarsus* is considerably compressed from side to side, much in the same way as we find it in the *Urinatoridæ*, and to the same end.

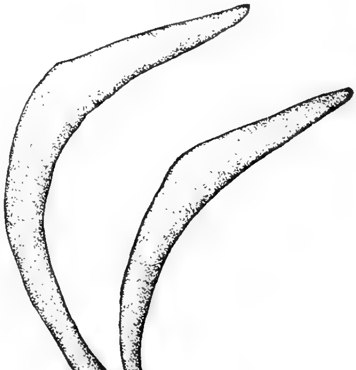


FIG. 14. The *furcula* of *Somateria dresseri*; life size. (Specimen 16989, Smithsonian collection.) By the author.

In order to show that this is simply another example in the skeleton of this Merganser of a physiological adaptation of structure to meet a certain requirement demanded on the part of its habits, I have, in Figs. 9 to 12, contrasted this bone, in two views, with the same bone taken from a specimen of the American Eider Duck, a bird far less noted as an habitual diver. It will be seen at a glance that fundamentally these two bones are essentially upon the same plan of structure, or, in other words, both are of an anserine type. The hypotarsus of this bone in *Mergus* consists of four vertical ridges—an inner large and longest one and three others

of equal length. They form the grooves for the usual flexor tendons passing to the toes.

Notwithstanding their lateral compression, the trochleæ of the distal end are very large, their median grooves distinct, and carried all the way around. The inner trochlea is elevated upon the shaft, and only descends as far as the base of the middle one. It is also turned slightly inward, and at the same time projects the farthest behind. The usual foraminal perforation is seen in the furrow between the middle and outer trochleæ, just above the cleft that divides them.

We find the *accessory metatarsal* of a moderate size and elevated far above the inner trochlear projection—not articulating with the shaft of the tarso-metatarsus, as in many birds, but attached to a ligamentous structure stretching between the lower part of the hypotarsus and the trochlea above mentioned.

The hind toe which it supports is fully developed, with basal joint and claw, though it is proportionately much smaller in comparison with the three anterior toes with their large joints.

These latter need no special description, they are articulated and fashioned as in the anserine fowl generally, as well as being conformable with the most usual arrangement in regard to number of joints allotted to the several toes. We may fancy that a certain amount of lateral compression is present in the phalanges of these podal digits, but if it is so, it is very slight, being little more in degree than is enjoyed by like skeletal parts in the feet of the *Anatinæ*. To present the characters of the skeleton of the *Anatinæ* more in detail, I have chosen for the purpose a specimen of the common Spoon-bill Duck (*Spatula clypeata*) and will now rapidly review its osteology.

OSTEOLOGY OF SPATULA CLYPEATA.

So far as its skeleton goes this bird is very closely allied to the Teals, a fact that perhaps might not be suspected on first sight from external appearances alone. Beyond its increase in size, the chief point in departure from this genus is seen in the enormous development of the premaxilla and a corresponding enlargement of the mandibles (Figs. 15 to 18, *Pmx.*).

In the dried and properly prepared skull of *Spatula*, this premaxilla is an elegant, symmetrically formed, yet delicate scroll of bone, and, so far as I am aware, unequaled by any similar structure among vertebrates. At the middle part of the anterior are there occurs a thickening, which in life supports the "nail" of the integumental sheath. Both this and the region on either side is quite thickly studded with foramina.

The external narial apertures are placed well back, as may be seen in Figs. 15 and 16, they being of a subelliptical outline. Comparatively speaking, these openings are considerably larger in the Swans and Geese, while in such a form as *Glaucionetta islandica* they

relatively occupy a mid-site on the mandibular side, the nasal being a broader bone. I have figured a side view of the skull of this latter Duck in Coues's "Key," second edition, where this feature may be seen.

Spatula and the Teals always have the extremity of the nasal median processes of the premaxillary remain distinct to a large extent in the cranio-facial region throughout life (Fig. 16). This is also well shown in the Mallard, less so in *Olor*, and barely observable in Hutchin's Goose.

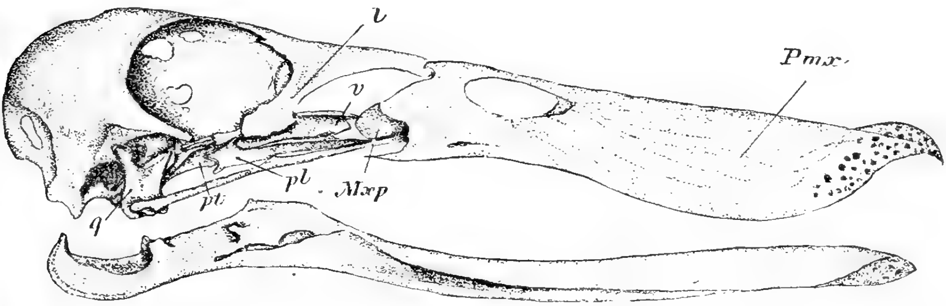


FIG. 15. Right lateral view of the skull of *Spatula clypeata*, ♂; life size. From a specimen in the author's cabinet, and used throughout this article where this form is figured. *l*, lachrymal; *Pmx*, premaxillary; *q*, quadrate; *pt*, pterygoid; *pl*, palatine; *Mxp*, maxillo-palatine.

Mobility of the cranio-facial hinge, however, does not seem to depend upon this condition, for in *Glaucionetta*, where a considerable amount is enjoyed, this individualization of the nasal processes of the premaxilla does not obtain to such a marked extent.

Confining ourselves for the present to the lateral aspect of the skull (Fig. 15), we find a notorious anatidine character very pronounced in *Spatula*, and this is the enormous development of the lachrymal (*l*) and the consequent antero-extension of the lachrymo-frontal region.

The descending process of this bone reaches backward toward the long sphenotic apophysis, nearly to touch it in *Glaucionetta*, in which Duck it usually lacks the terminal dilation so prominent in our subject, and still more so in the Swans. The interorbital septum rarely shows any deficiencies in its bony plate, the Golden-Eye being the only form in which I have met such a condition, and in this fowl it is very small. In all *Anatidæ* the osseous pars plana seems to be aborted, simply a low, bony ridge indicating where it is developed in other birds. The mesethmoid is developed, however, as a strong median abutment extending far forward beneath the cranio-frontal region.

A vacuity usually occurs throughout the group, high up on the posterior orbital wall, though the foramen for the exit of the olfactory nerve is not notably large, and the one for the optic is distinct from the outlying smaller nerve apertures about it.

Most Ducks and the Brant have the track for the passage of the olfactory to the rhinal chamber an open groove, while in *Olor* it may be practically overarched by bone.

As already intimated in a former paragraph, *Spatula*, in common with others of the suborder, had a greatly lengthened sphenotic or

post-frontal process, while the squamosal projection would hardly attract attention in any of them.

The infraorbital bar is long, nearly straight, narrow, and much compressed from side to side. On its upper edge beneath the lacrymal a little papilli-form elevation is usually seen. Its quadrate extremity is slightly tilted upward before it sinks into the pit in that bone. This upward deflection is best observed in the Swans, not being well marked in our Broad-bill. The maxillary (*Max*) extremity of the bar is in all firmly wedged in between the palatine and the dentary process of the premaxilla, being completely fused with these bones in the adult.

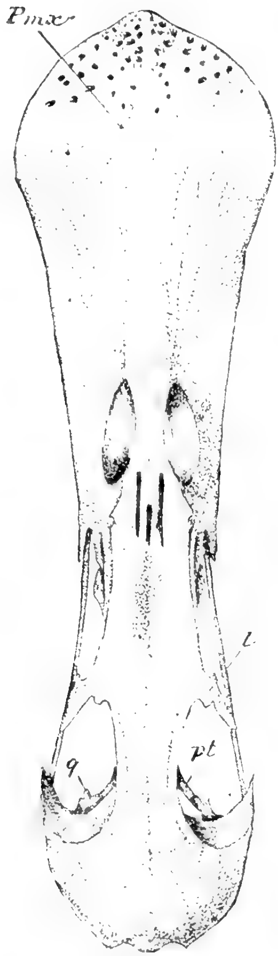


FIG. 16. Skull of *Spatula clypeata* seen from above; mandible removed; life size. Letters as before.

Anatidæ as a rule, and *Spatula* form no exception, possess a large and massive *quadrate*. This bone has in them a broad and subcompressed body of a quadrilateral form, to the antero-superior angle of which a spine-like orbital process is superadded and rather deflected toward the median plane. The mandibular foot of this element supports two elongated facets, placed side by side with their major axes extended in the transverse direction. The inner of these facets is always the smaller.

At the mastoidal extremity of the quadrate we find a globular head, fairly divided in two by a shallow groove running from before backward. This articular end is well incased by the surrounding bone.

The quadrato-jugal and pterygoidal articulations require no special mention, they being much as we find them in a number of other water fowl.

Anatidæ have the lateral aspect of the cranium smooth and evenly convex, while lower down a shallow and vertically elongated crotaphyte fossa can generally be pretty well made out. I find it least pronounced in Hutchin's Goose, while it is quite strong in the Garrot. In all cases it is produced downward upon the highly developed temporal wing, which forms the back part of the bony ear-conch. This latter is conspicuous in having, in most Ducks, incurling margins to protect it. These latter are not so manifest in the Geese, and they are absent entirely in *Olor*.

In Fig. 16 we have an upper view of the skull of *Spatula*, and this permits us to gain a very good idea of the enormous development of the premaxilla (*Pmx*).

The fronto-lacrymal region we observe to be unusually elongated, and in this form concaved in a longitudinal median direction. This latter feature obtains also in the Mallard and the Teals, where it is quite as well marked, while, on the other hand, in the Swans, Brant, and Geese this fronto-lacrymal region is not so strikingly lengthened, being flat in some of the latter and mounded up in some *Cygninæ*.

The space between the orbital margins on this aspect shows considerable width, more particularly in such forms as *Glaucionetta*, where it is marked by a longitudinal median crease.

The supraorbital glandular depressions for the nasal glands, so prominent in many of the Auks and other water fowl, are here in the *Anatidæ* rarely well marked.

In *Spatula* they consist in a very narrow trimming off of the edge of the orbital peripheries, barely perceptible in the Mallard and *Anas carolinensis*. In *Glaucionetta* they are better developed, but in this Duck they are really moved down so as to form one of the features of the lateral aspect of the skull (Fig. 63, *w*, Coues's "Key," 2d ed.). They are quite well marked in the Hutchin's Goose.

Spatula, *Anas boschas*, and the Teals have a strongly incised notch on either side, at the anterior arc of the supraorbital rim, which seems to define the posterior ending of the lachrymal bone. It is absent in the Garrot, but again characteristic in Swans and Geese.

The vault of the cranium behind is, upon this aspect, usually smooth and rounded. A longitudinal crease may pass it in the middle line, and elevations on either side in some forms (*Spatula*, *Olor*) faintly indicate the divisions of the encephalon within.

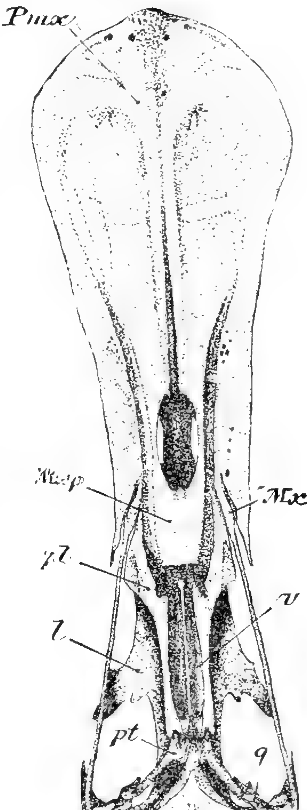


FIG. 17. Under side of the skull of *Spatula clypeata*; mandible removed; life size. Same specimen with *Mxp*, maxillo-palatine, and the other letters as before.

Turning now to the under view of the skull of the Spoon-bill, we are to note the great concavity of the premaxillary, with its sharply-defined parial gutters for vessels and nerves and their ramifications.

As is well known, all the *Anatidæ* exhibit the typical desmognathous arrangement of the palatal bones. The maxillo-palatines unite in the middle line to form a large bony mass (*Mxp*), in front of which there occurs in all the Chenomorphæ, that I have been enabled to examine, a more or less cleanly cut elliptical opening, the remnants of a much greater vacuity of other birds. In the Swans these maxillo-palatines are

quite spongy; in *Branta canadensis hutchinsii* they unite with a firm lamelliform nasal septum that makes a long abutment against the roof of the rhinal chamber above. This nasal septum is entirely absent in *Spatula*, and illy developed in *Anas carolinensis* and the Mallard.

My drawing of the basal view of this Duck illustrates Coues's "Key," (Fig. 78), where the above points may be compared with advantage.

In *Spatula* (and the arrangement, with a few unimportant minor differences, holds good for the group) the palatines (*pl*) are horizontally compressed at their anterior ends, where they form anchylosed schindylesial articulations with the premaxilla and maxillaries, as already described. The body of one of these bones is slenderer along its middle length, separated by a wide interval from its fellow, and half the distance from the vomer (*v*).

Its "ascending process" is short, and is carried along the upper vomerine margin, where it unites with the opposite palatine to form a lon-

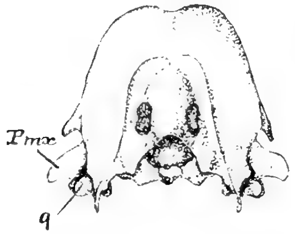


FIG. 18. Rear view of skull of *Spatula clypeata*.

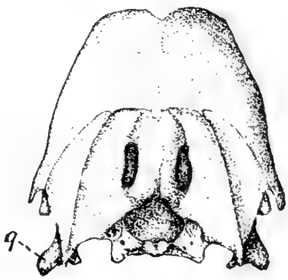


FIG. 19. Rear view of skull of *Glaucionetta islandica*. Both figures life size, from the specimens. Mandibles removed. Letters as before.

gitudinal, rib-like re-enforcement along the upper edge of that bone. It is only in this situation that the anserine palatines meet each other.

The joint that one of these bones makes with the corresponding pterygoid (*pt*) is a sort of mortise-and-tenon arrangement that very perfectly meets the requirements of the parts involved.

The palatines barely escape resting against the under side of the rostrum of the sphenoid, which passes immediately above them. This is true of all the *Anatidæ* so far as I have seen.

As to the vomer (*v*) proper, we find it to be a thin lamella of bone in the median line, supported, as pointed out above, by the rib on its upper margin developed from the ascending processes of the palatines. This portion is carried forward by a thickening of the vomer itself, somewhere beyond its middle, as a protuding spine like anterior process.

This spine usually rests in a groove formed by the union of the maxillo-palatines behind, though in the skull of a female Mallard before me not only this projection, but a good share of the vomerine plate has fused with this maxillo-palatine mass in part, to become immovably connected with them.

The lower margin of the vomer is sharp, and the whole plate is gently arched in such a manner as to make the upper edge convex along its continuity, the reverse obtaining below.

When speaking of the palatines I neglected to invite attention to the notch found on the inner margin of either one of them about opposite the anterior termination of the vomerine plate. This notch is converted into a foramen in the Mallard, and entirely absent in Hutchin's Goose and the Whistling Swan.

Spatula possesses a pterygoid (*pt*) of the same general form it assumes in any of the *Anatidæ*. Its shaft is short and straight, while its anterior end is much enlarged, first, by a descending lamina of bone developed upon it and, secondly, by the large sessile, elliptical facet on its opposite side for articulation with a similar facet on the sphenoidal rostrum. Anterior to this facet the pterygoid develops an upturned process of spine-like dimensions, which, when the bones are *in situ*, is closely applied to the back side of the ascending process of the palatine. Below this process the pterygoid is deeply and roundly notched to receive a peg-like projection on the palatine, which movably fits into it.

The projecting and rounded postero-external angle of the palatine extends below this pterygoidal articulation.

Generally the lower border of the rostrum is rounded; it is very broadly so in Brant, though it becomes quite flat in *Glaucionetta;* there it may be carried forward as a projecting process.

The anterior ethmoidal edge is always sharp, sloping forward and upward to become a median crest on the under side of that part of the bone which abuts against the frontal region for its entire length.

In *Spatula* the basitemporal region is quite broad, and marked by a median and rounded ridge. This is carried out upon the pointed lip of bone that under-laps the double entrance of the Eustachian tubes in front. A decided dimple is found in front of the sessile and superiorly notched occipital condyle, while the foramen magnum is large, of a cordate outline, with its apex directed upward.

Laterally we find the descending temporal wings, with the usual group of foramina to the inner side of each, at the base of quite a well-marked little fossa.

The plane of the foramen magnum makes an angle of about 45° with the backwardly produced plane of the basis cranii.

A posterior aspect of the skull of this Duck (Fig. 18) shows a conspicuous supraoccipital prominence, with a large, vertical, and elliptical foramen opening into the cranial casket on either side of it. The occipital area is well divided off from the crotaphyte fossæ by a raised ridge which surrounds it. These last-named depressions are separated in the median line by quite an extensive interval. I believe they never meet in any true Duck.

This description of the cranial base and posterior aspect of the skull

in the Spoon-bill practically answers for the Mallard and the Teals, though, of course, slight differences do exist.

In *Glaucionetta islandica* the basis cranii is proportionately flatter; the temporal wings less manifest; a separate ridge bounds the fossa for the nerve and arterial foramina externally, and the condyle is more prominent and its superior median notch very deep. The vault of the cranium is very lofty in this Duck (Fig. 19), and the ridge bounding the occipital area almost crest-like.

Speaking of the unusual height of the cranial vault in the Garrot, we find this bird very peculiarly constructed in this particular, for not only is the brain case of a size above the average for the group, but a curious and not inconsiderable diplöic cavity overlies the whole top of the skull, extending as far forward as the mesethmoid. Here it is interrupted by a pair on either side, one in front of the other, of deep and sharply defined chambers, with their apertures facing directly downward. This condition is not so pronounced in a young female *Glaucionetta*, a specimen of which I have before me.

Branta has a very large brain-case, and upon the under side of the skull of a specimen of *B. canadensis hutchinsii* we note that a quadrate has an area of no mean size, and nearly horizontal, extending to the rear of its mandibular facets. In this Goose, too, we find a very broad and flat basi-temporal area, with the shield to the entrance of the Eustachian tubes nearly aborted. These latter appertures are wide apart at the situation usually protected by it. The temporal wings are feebly developed in comparison with the *Cygninæ*, and the occipital condyle is almost pedunculated. The group of foramina to its inner side of either temporal wing is situate at the base of a well-defined fossa specially designed to receive them.

Finally, we observe that the form of the foramen magnum is more elliptical in outline rather than cordate, as we found it in the Ducks. Above it the supraoccipital prominence is very conspicuous, while the foramina on either side of it may or may not exist.

In the skull taken from a magnificent male specimen of *Olor columbianus** I find the basi-temporal triangle comparatively very small, with the dimple anterior to the condyle deep and having parial ones placed side by side in front of it. The descending temporal wings are enormously developed, each one overshadowing a considerable excavation to its inner side.

The condyle is relatively smaller than it is in the Geese, and its superior notch not so well marked, while the foramen magnum is quite circular in outline. Elliptical vacuities may or may not exist at the sides

* I am greatly indebted to the generosity of Mr. G. Frean Morcom, of Chicago, for this present. The bird was forwarded to me by Mr. Morcom from Chicago to Fort Wingate, N. Mex., by express. It arrived in excellent condition in the flesh, and the fine skeleton it afforded me has been of the greatest service in the present connection. When this memoir is published it is my intention to present the specimen to the Smithsonian Institution at Washington as a type.—R. W. S.

of the fairly well-pronounced supraoccipital elevation. The plane of the occipital area is nearly or quite perpendicular to the plane of the *basis cranii.*

Anatidæ have their skulls more or less perfectly permeated by air, and when properly prepared are really structures of great beauty, as is the glistening white skull of the Swan before me, which is so exceedingly light for its size and withal so graceful in outline.

Few and unimportant are the differences that are found to exist between any two *mandibles* of representative *Anatidæ*, the general type of the structure being quite a uniform pattern, as it prevails throughout the entire group. Perhaps *Spatula* offers us as great a departure from the common form of the anatidine mandible as any American Duck we have, and even here we find, on side view, that it possesses all the essential characters of the bone as found in the group. Seen upon this latter aspect we have presented us for examination the lamelliform and vertical angular processes. These are greatly produced directly backward, to be abruptly recurved upward at their extremities. This is the style also in *Olor*, but in Hutchin's Goose they are saber shaped and gradually recurve upward. Beyond this process the articular facet projects from the ramal side, and at a varying distance (for the species) in front of this we find a constant process for muscular attachment. This last is situate at about the middle of the deepest and most plate-like portion of the ramus, and in a Swan is ridge-like, being connected with the coronoid process on the edge of the bone immediately above it.

In front of this the ramal vacuity—a narrow slit—is usually completely closed by the splenial element.

The bone now becomes shallower in the vertical direction, its superior and inferior borders rounded, while a well-defined gutter for the passage of nerves and vessels marks its entire length.

As a rule, among the *Anatidæ* the symphysis is rather deep, rounded beneath, and correspondingly concave above, the under side being thickly studded with vascular foramina. *Spatula* has a somewhat different anterior ending from this, as is shown in Fig. 20.

In the middle line in front a sort of "nail" is developed like the one found on the superior mandible, though not so strong. The superior ramal margins are continued round this projection, forming its edge, while the spoon-like dilatation is insured by the outer ramal sides shelving away from this upper border, so as to face upward and outward rather than directly outward, as they do posteriorly.

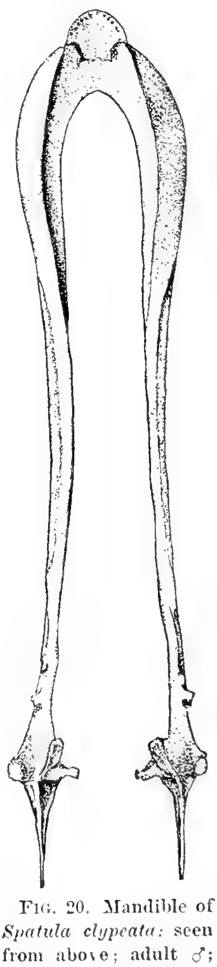


FIG. 20. Mandible of *Spatula clypeata*: seen from above; adult ♂; life size, from the specimen.

The form most common for the mandible to have, as viewed from above, is well exemplified in *Glaucionetta*, as shown in Fig. 21, which presents this aspect of the bone in the Garrot.

The articular projections lie nearly in the horizontal plane, and each one supports the two concavities for the mandibular foot of the quadrate. A rather slender intwined process directed upward and toward the medial plane projects from the inner one. This may present a small pneumatic foramen at its extremity. Beneath either of these articular portions of the mandible, and to the inner side of the angular process, we discover a deep conical fossa, with its apex to the front.

FIG. 21. Mandible of *Glaucionetta islandica*; seen from above, adult ♂; life size; from nature.

It is intended for muscular insertion, and is present, I believe, throughout the group.

The mandible is very imperfectly pneumatic, particularly in the Brant, where the bone sometimes, if not always, entirely lacks this condition.

For the general form assumed by the *hyoidean apparatus* in these birds the reader is referred to my figure of these parts as they occur in *Branta canadensis*, in Coues's "Key," second edition, on page 167 (Fig. 72).

Here we find an elongated elliptical piece in front, of some width, which represents the glossohyal and absorbed ceratohyals. It develops a median facet anteriorly for articulation, with a cartilaginous rod, which passes into the soft part of the tongue proper.

This glossohyal is longitudinally concaved beneath and correspondingly convex above; it articulates with the fused basi-branchials, the first one of which is by far the stouter element, the second almost spiculiform in its dimensions, and produced by a cartilaginous tip behind.

The thyrohyal elements consist each of the two usual parts, and these greater cornua curl up gracefully behind the skull, after the fashion of the class generally.

Without entering upon details, I find after careful comparison of a sufficient number of skulls, that of the Teals, the Blue-winged species (*A. discors*), more nearly approaches *Spatula* than any of that genus, while, on the other hand, a very close resemblance is seen to exist between the skull of *Spatula* and that of the Mallard, the most evident points of difference in these last being the shape of the premaxilla and the more robust type of skull possessed by the Mallard. With but very few exceptions, I believe I have shot every species of Duck in this country, yet, at the present writing, I regret to say that I have not at hand the skulls of the genera *Dafila*, *Anas strepera*, nor *Anas penelope*,

and it will be very interesting to compare these forms on some future occasion with those described in the foregoing paragraphs.

It is a well-known fact that the number of vertebræ in the spinal column of the *Anatidæ* is by no means constant. Even genera supposed to be quite nearly related may differ in this particular, so that careful records in this direction are very much needed, and when a sufficient number have been taken to insure absolute accuracy such data will be of service.

In the subjoined table I have but little to offer, but it is the result of a careful count in each case, and will go to show some of the differences referred to and the method of comparison.

Species.	Number of vertebræ in cervical region without free ribs.	Vertebræ that bear free ribs not reaching sternum.	Dorsal vertebræ (inclusive).	Vertebræ consolidated with pelvis (inclusive).	Free caudal vertebræ (to which pygostyle is to be added).
Olor columbianus	22	23d	24th to 28th	29th to 45th	46th to 52d.
Spatula clypeata	15	16th	17th to 21st	22d to 37th	38th to 44th.
Anas discors	15	16th	17th to 21st	22d to 37th	38th to 43d.
Glaucionetta islandica	15	16th and 17th	18th to 21st	22d to 37th	38th to 43d.

Now, in the case of *Spatula* and *Glaucionetta*, in the specimens before me, the thirty-eighth vertebræ, though free and really a caudal, lies within the grasp of the hinder ends of the iliac bones, whereas in the Teals this segment is found one vertebra's length behind them or entirely without their grasp. It will be seen, however, that this does not affect the total count, it remaining forty-four for the first-named genus and but forty-three for the Garrot. I mention this because specimens may yet be found where this thirty-eighth vertebra has united with the pelvis, as from the position it occupies it is perfectly possible for it to do in the genera mentioned.

The general characters of these segments as they are exhibited by most Ducks are very well shown in *Spatula*.

The *atlas* has its cup perforated by the odontoid process of the atlas vertebra, and is characteristics in having the lateral canals—a feature, so far as I am informed at present, that is common to the Anseres.

An open carotid canal is provided for by the sixth to the twelfth vertebræ, after which a strong median hypapophysis takes its place, and this becomes tricornuted in the sixteenth segment and first dorsal, while in the eighteenth and nineteenth it is a long median plate.

The fifth and sixth cervical usually has the best-marked neural spine, which is there a long, though not high, median crest. The lateral canals in the first half of the cervical region are long and tubular, while the parapophyses are co-ossified for nearly their entire lengths with their sides. *Anatidæ* possess the "heterocœlous" type of articulation among the centra of the spinal column. A strong hypapophysis is found on the second and third cervical vertebræ, to be much reduced in the

succeeding one, while the following segments in the skeleton of the neck are notably broad and rather long. In this region one thing is sure to attract our attention, and this is the brevity of the pre- and postzygapophyses, an arrangement which has the effect of very materially reducing the size of the intervertebral spaces or apertures.

In the dorsal region the vertebræ are not only locked together by their close-fitting neural spines, but a very extensive system of metapophysial and other bony spiculæ render the strapping still more efficient. The transverse processes are very wide, too, so that, notwithstanding the fact that these segments are all free, the mobility enjoyed by this division of the column is very much compromised. Pneumaticity is but very imperfectly extended to the vertebræ of the column, especially in the cervical region; while this is likewise true of the Swans, this condition in them is very much more complete, and their dorsal vertebræ are wonderfully well provided for in this particular.

The *ribs* seem always to be non-pneumatic, with large anchylosed unciform processes, being wide and flat in the body above the points where they are attached. *Glaucionetta* is notorious for both of these characters.

Spatula has on one side seven ribs that connect with the sternum by costal ribs; one pair behind these, where the hæmapophysis fails to reach that bone, and, finally, a small floating hæmapophysis clinging to the posterior margin of the latter. The last two pairs of vertebral ribs come from the sacrum and are without unciform processes.

This arrangement of the ribs prevails also in *Anas cyanoptera*, while in *Glaucionetta* the series leads off with two pairs of free ribs, one on the sixteenth and one on the seventeenth vertebra, the following six connecting with the sternum, and three pairs coming from the consolidated sacral vertebræ, making in all nine pairs of ribs to each side, the last three not bearing unciform processes.

In *Olor columbianus* the arrangement is again entirely different. Here we find the series leading off with one pair of free ribs (on the twenty-third vertebra), followed by *nine* pairs that connect with the sternum by costal ribs and completed by a purely floating pair that neither joins with the pelvis above nor the sternum below. This gives the Swan eleven pairs of ribs. Of these the first, and the last four are without unciform appendages. In those ribs where they do occur they are anchylosed to them and are not notably large. The last four pairs of ribs come from beneath the ilia in this Swan and curve far backward, reminding us of a condition that is still more pronounced in the Loons. Nor is this the only feature in *Olor* wherein it resembles that family, as we will see further on.

This Swan has a low median hypapophysis on each dorsal vertebra, and the neural crests of these segments are comparatively low, being laced together by long spiculæ, as we described them for the Ducks.

The skeleton of the tail is much as it is in *Spatula* and Teals, in

which genera the diapophyses are wide and spreading, while beneath, the ventral apophyses are anchylosed to the centra upon which they occur and hook forward over the preceding vertebral body. The pygostyle in these and most forms of the group is somewhat elongated, of an irregular quadrilateral outline, with thickened posterior border.

Glaucionetta has very wide and spreading transverse processes to its caudal vertebræ, and the chevron bones upon the last two are free and rest mainly upon the intervertebral cartilage, as a greater series of them do in the Swans.

Turning our attention now to the consideration of the pelvis, we find this compound bone in *Spatula* presenting us upon its dorsal aspect the following points for our examination: The ilio-neural canals are completely closed in by the ilia meeting and anchylosing with the crista of the leading sacral vertebræ. This is the case, I believe, throughout the entire order. On either side of this the pre-acetabular portion of the ilium is longitudinally concaved, each anterior border being emarginated by raised bone and embellished with a few projecting spiculæ.

The post-acetabular sacral portion of the pelvis is in general in the horizontal plane, being pierced in an irregular manner by a few scattered and small inter-diapophysial foramina, while a median furrow, deepest behind, marks its entire length.

From this part of the pelvis the sides slope gently away. The posterior margin is more or less unevenly notched; the notch indicating on either side, however, the point of union between ilium and ischium is constant both as to occurrence and location. So far as we have thus described the bone it will answer in general terms for the Teals, but in *Glaucionetta* the pre-acetabular area is notably shorter, while behind the bone is more spreading, the interdiapophysial foramina far more numerous and larger, and, finally, the posterior margin is nearly even. Upon the lateral aspect of the pelvis in *Spatula* we find rather a large cotyloid ring, surmounted at its upper and back part by a modest antitrochanter. The ischiac foramen is extensive and subelliptical in outline. Behind this we sometimes find, both in this species and in the Teals, a thin tract of bone, which thinning may be carried to the point of forming another foramen, or a post-ischiac foramen, which is quite large in some specimens.

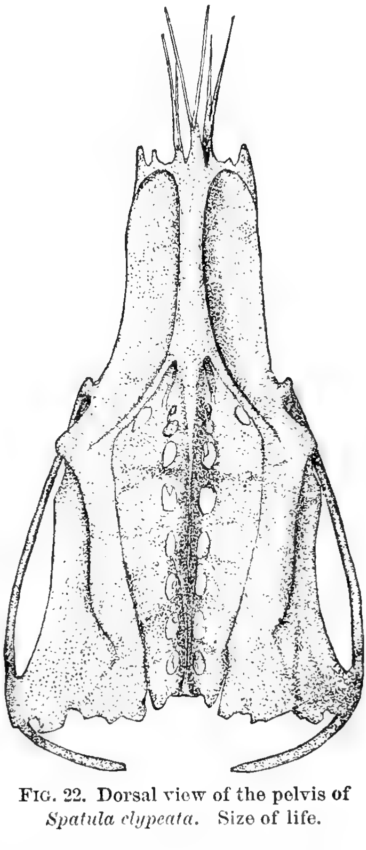


FIG. 22. Dorsal view of the pelvis of *Spatula clypeata*. Size of life.

March 26, 1889.

In all the *Anatidæ* that I have examined a pro-pubis is to be found jutting forward from its usual site. This is the case in *Spatula.* Behind this a small obturator foramen, nearly closed in, is to be noted, while the obturator space is very large and completely surrounded by bone behind, through the foot-like process afforded by the ischium. This latter projection articulates with a facet, intended for that purpose, on the upper border of the post-pubis.

The post-pubis is a slender rod as it passes beneath the obturator space, but after its articulation with the ischium posteriorly it has its width nearly doubled, and in *Glaucionetta* the hinder ends are slightly enlarged. This latter Duck departs from the above description principally in such a minor detail as having a relatively much larger ischiac foramen and longer obturator space.

In all of these species we find the pelvic basin upon the ventral aspect very capacious, both as to its depth and width.

As I have already stated elsewhere, the pelvis in *Olor* has a very different form from that bone as we find it in the Ducks. It assumes a shape that at once brings to our mind the mergine pattern, with its greater length as compared with its width; the almost entire disappear-

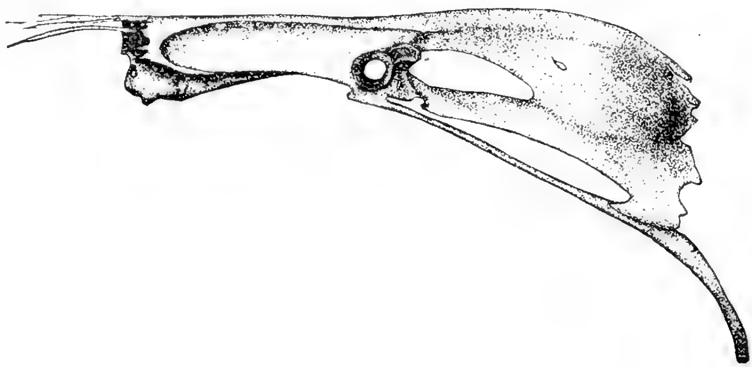


FIG. 23. Left lateral aspect of pelvis of *Spatula clypeata;* life size. Same specimen as Fig. 22.

ance of the interdiapophysial foramina, and the broad, paddle-shaped extremities of the post-pubic elements. This model sees its extreme modification in the *Pygopodes*; and if we remove the intrasternal chamber for the accommodation of the tracheal loop, we find in the sternum, too, of the Swan a great deal to remind us of that bone in *Urinator.*

Spatula possesses, in common with most Ducks, a completely nonpneumatic *shoulder girdle.* In it we find a broad, U-shaped furcula, devoid of hypocleidium and with its long, pointed, clavicular heads extending almost directly backward. On the upper side, where either of these latter merge with the limbs, we find a peculiar little peg-like process, that is quite characteristic of most *Anatidæ.* The scapula is long and curved, the curve being in the plane of its blade, with the convex border mesiad. Its posterior end is simply rounded off, and its head makes a firm articulation with the broad, scapular process of the coracoid.

This latter bone has its shaft much compressed from before, backward, while its sternal extremity develops an unusual expansion, the infero-external angle of which is truncated.

Anas discors agrees in its pectoral arch, in the main, with the one just described for the Broad-bill. It has, however, a rudimentary hypocleidium present.

This latter feature is entirely absent in *Glaucionetta*, where the furcula is very strong and its U very broad. Otherwise the bone is generally marked by all the characters it bears in the Ducks. The blade of the scapula in *Glaucionetta* is much arched, and shorter and broader than it is in the Teals. The coracoid presents nothing peculiar, having much the same form that it has in *Spatula*, though it agrees with the Teals in having a comparatively longer shaft.

Aside from its greater size, *Olor* possesses a scapula very like that bone in *Glaucionetta*. The Swan has its coracoid, however, very short and thick-set, and does not at once suggest to us its family relations, though a moment's study is sufficient to trace the modifications and resemblance. The unique form assumed by the furcula of this stately fowl is well known to us. Its clavicular heads are long drawn out to terminate posteriorly in sharp points. Moreover, the bone is highly pneumatic, the foramina being found well up on the outer aspect of either limb, in a longitudinal excavation that there occurs. These clavicular limbs gradually approach each other as they descend, and when they come close to and opposite the middle points of the anterior and vertical borders of the tracheal entrance to the sternum they are reflected upward, and unite as a U-arch in the median line just beneath the manubrium. The anterior aspect of this secondary arch is convex, while behind it is much concaved, especially at its highest point, where a small circumscribed pit occurs. The object of this modification of the fourchette in the Swan is to permit the tracheal loop that enters the carina of the sternum a passage-way, but the requisition of the entire arrangement is one of those problems in anatomy which, I believe, still awaits a final solution.

The *sternum* affords another instance of skeletal likenesses between

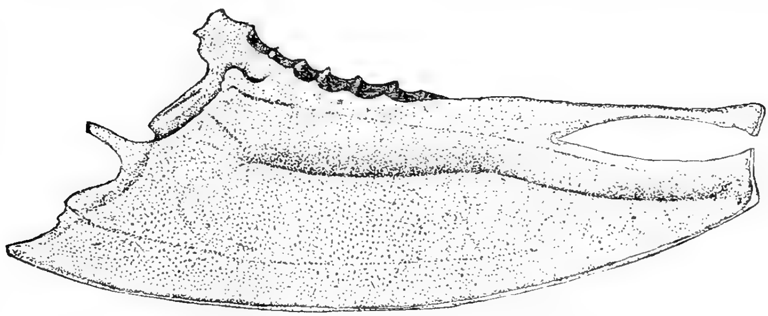


FIG. 24. Left lateral aspect of sternum of *Spatula clypeata*; life size. Same specimen as before.

the genus *Spatula* and the Teals; indeed, this bone in the latter genus is to all intents and purposes the perfect miniature of the sternum of

the former Duck. On its dorsal aspect the bone is much concaved throughout and presents a single, median, pneumatic foramen just within its anterior border. This aperture, though a smaller one, is also seen in the Garrot, but the sternum of that Duck is a non-pneumatic one.

It will be observed from Fig. 24 that the sternum of the Spoon-bill possesses quite a prominent, peg-like manubrium, and that its sharp, anterior carinal border slopes to the front, forming an acute angle with the convex and ribbed inferior margin of the keel at their point of intersection.

This keel extends the entire length of the sternal body, and is withal rather a deep one. The usual swell that fortifies it in front is uncommonly broad. Above the manubrium, in front, the coracoidal grooves unite in the median line, and the common bed thus formed is carried out laterally, on either side, to a point opposite the middle of the base of the costal process. These latter projections are rather lofty and prominent, each being of a broad, quadrilateral outline.

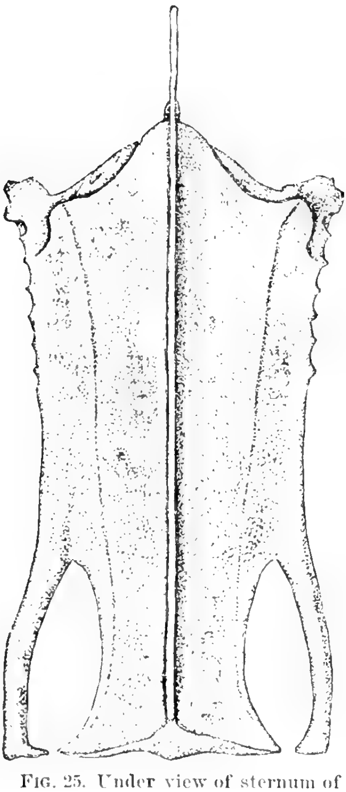


FIG. 25. Under view of sternum of *Spatula clypeata*; life size. Same bone as shown in Fig. 24.

Either costal border occupies less than half of the lateral margin, the remainder being somewhat curved and cultrate.

Regarding this bone from a pectoral aspect (Fig. 25), we notice that the form of the sternal body is oblong, with a slight outcurving of the lateral xiphoidal processes behind. These latter form the external boundaries to the large subelliptical vacuities, one on either side of the hinder extremity of the bone; but they fail to convert these apertures into true fenestræ, from the fact that their inturned tips never reach the external angles of the mid-xiphoidal prolongation, as shown in the figure. This latter projection always has its posterior margin fortified by a raised and thickened edge, which is continuous with the rib of the inferior carinal border.

The principal muscular line seen upon either side of this wall of the sternum, extends directly from the middle point of that lip of bone which underlaps the outer end of the coracoidal groove, to follow the inner edge of the xiphoidal notch to the apex of the postero-external angle of the mid projection, traveling the entire length of the sternum, of course, to do so.

Now *Glaucionetta islandica* has a sternum of an entirely different form from the bone as I have just described it for *Spatula* and the Teals.

In the first place, its body is relatively much shorter for its width than it is in those Ducks, while in front the manubrial process has entirely disappeared. Again, the costal processes are loftier and more conspicuous. The xiphoidal extremity of the bone is very broad and is pierced well within its hinder margin, on either side, by an elliptical foramen, as shown in Fig. 26, where it will also be observed that the carina does not extend the entire length of the sternal body, but stops short at the

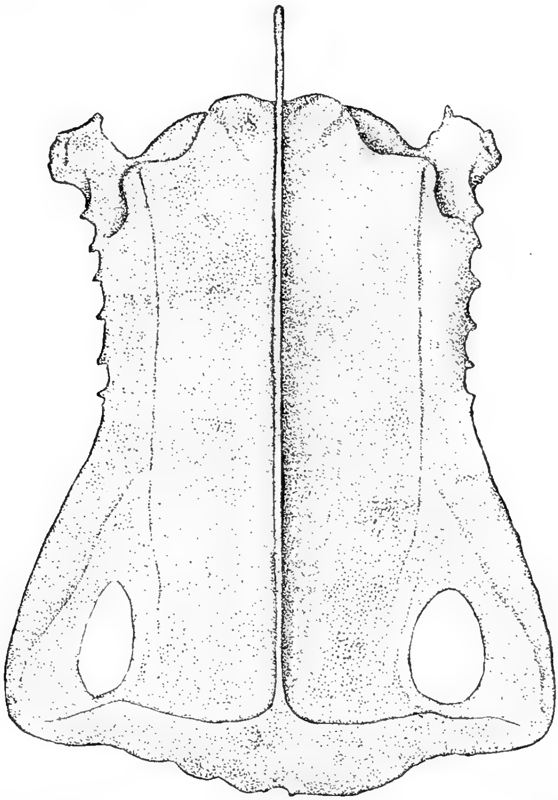


FIG. 26. Pectoral aspect of sternum of *Glaucionetta islandica*; life size. From a specimen in the collection of the author.

middle point of a raised line, that, being produced as it is, is tangent to the posterior arcs of the xiphoidal fenestræ.

The muscular lines take about the same course as they do in *Spatula*, with the exception that their posterior ends are inclined inward rather than outward, as in the form mentioned.

This form of sternum agrees in many particulars with the bone as we find it in *Mergus*, though in the Eider Ducks, as I have elsewhere pointed out, the xiphoidal extremity is deeply two-notched.

Such differences certainly are significant, and must be awarded their due share of weight in the search for affinities among the several forms of this order, and it will be interesting to find with what similar characters they are associated.

Another engaging subject in the anatomy of the *Anatidæ* is the study of the various forms taken on by the osseous labyrinth at the bifurca-

tion of the bronchi. This is of a very unique shape in *Glaucionetta*, and I have figured a specimen of it as it occurs in this Duck in Coues's "Key," showing the development from behind (second edition, Fig. 98).

It is my intention, on some future occasion, to make a thorough comparison of these tracheal caskets as they are found in our American Anseres, continuing the labors of Garrod and Yarrell in that direction.

Anseres always have the extremities powerfully developed, and in consequence we find strong skeletal supports for their pectoral and pelvic limbs. The bones that enter into them, however, rarely offer anything peculiar or make any marked departures from the average type of the skeleton of the parts in Aves.

In Figs. 27 and 34 of Coues's Key I offer drawings of the pectoral and pelvic limbs of *Glaucionetta islandica*, and they give a very good idea of these bones as they occur among the Ducks generally. It must be noted, however, that in Fig. 27 (of the "Key") another small joint must be added at D, in order to perfect the limb. This part of the skeleton in *Glaucionetta* is completely non-pneumatic; not the case with many other Ducks.

It must likewise be observed that in Fig. 34 the patella is not shown, whereas I believe this fowl possesses one in common with other Ducks.

Professor Coues lettered these two drawings of mine himself, and by an oversight has made in Fig. 34 *am.* point to one of the trochleæ of tarso-metatarsus instead of the accessory metatarsal.

Olor, the Teals, and the Spoon-bill all have a perfectly pneumatic humerus, the foramina being found at their usual site.

In the last-named species this bone is considerably longer than the non-pneumatic ulna and radius. Its radial crest is rather low and short, while the ulnar one curls conspicuously over the pneumatic fossa. Between this latter and the humeral head a deep notch, or rather groove, is found.

The shaft is of a glistening whiteness, and composed of a wonderfully compact tissue, and shows scarcely any curve along its continuity. The distal extremity presents the usual characters, the oblique and ulnar tubercle on the radial side and a broad passage for the tendons on the other.

Along the shaft of the ulna we notice a faintly pronounced row of papillæ for the secondary quill-butts, a longitudinal muscular line marking the opposite side. This bone is considerably bowed along its proximal third, while, on the other hand, the radius is nearly straight. The two carpal elements which remain free throughout life in Aves generally are here present, and of a comparatively large size. *Ulnare* in most Ducks, and less so in the Swan, shows a strongly-defined groove down its anconal aspect for the lodgment of the tendon which there passes.

Carpo-metacarpus presents the usual form, and its main shaft is more than two-thirds as long as the radius. There are two phalanges in pollex digit, as there are three in index, the blade of the proximal joint of

this latter finger being narrow and solid; the little joint behind it extending rather more than half way down its posterior border.

Among the Swans the general plan of the limb is the same, but the humerus, an exquisitely beautiful bone in these birds, is but very slightly longer than the ulna.

The skeleton of the pinion is quite as we find it in the Ducks.

I have yet to find a true American anserine bird that possesses a pneumatic bone in its pelvic limb. All the species before me entirely lack this character.

In *Spatula* the trochanterian ridge of the femur has a thick, curling crest on the antero-superior aspect of the bone, but at the summit it is leveled down to the same plane with the articular surface. The head is rather large and sessile and the excavation for the round ligament shallow.

We find the distal extremity unusually large; indeed, all the bony structures that enter into a Duck's knee-joint are large and massive. This is particularly the case with the condylar extremity of the femur in *Glaucionetta*, where these prominences are powerfully produced behind, and a wide and deep cleft splits the outer one for the fibular head. In this form, too, a deep pit is found in the popliteal fossa.

Returning to the femur of *Spatula*, we note that its shaft is nearly straight, being marked by the usual muscular lines, while the pit just spoken of is absent. The rotular channel extends slightly up the shaft above the condyles, whereas in *Glaucionetta* this is not the case, and in this Duck the femoral head is notably large and extensively excavated on top; the lower third of its shaft is somewhat bowed to the front and a little twisted, recalling to our mind the power of that peculiar arch as exhibited in such a marked degree in *Urinator*.

The Spoon-bill, and I suppose other Ducks will show the same, has an extraordinarily formed patella, being flat on top, wedge-shaped in front, broad and concave behind, deeply excavated and arched below, while across its anterior face it is profoundly slit in the oblique direction for the tendon of the ambiens muscle.

In the tibio-tarsus we find a large, flake-like, and jutting procnemial crest, which curls toward the fibular side and ends abruptly high up on the shaft. The ectocnemial crest is also turned outward, but is low and thick. These prominences are but slightly elevated above the articular summit of the bone, while in *Glaucionetta* they are carried up in such a manner as almost to rival the Grebe in this particular, having very much the same form.

The tibio-tarsal shaft in *Spatula* is straight, smooth, and subcylindrical. It affords at its outer side the usual ridge for the accommodation of the fibula. This is very long in the Garrot.

At the distal extremity we find that the entire end is considerably bent toward the inner side, a character it presents in many other *Anatidæ*. The intercondylar notch is for the most part very wide and shal-

low, being deepest anteriorly. Above it, in front, the direction of the deeply excavated groove for the extensor tendons is influenced by the obliquity of the bone spoken of above. The bony bridge that spans it is thrown directly across.

Nothing of particular interest marks the fibula, it having the form we usually find in the class. In this specimen of the Spoon-bill its feeble lower end anchyloses with the tibio-tarsal shaft at about half way down its length. It is very much longer in *Olor*, where its method of ending is the same.

Equaling about half the length of the leg bone it articulates with, the tarso metatarsus also proves to be a strong, stout segment in the limb of this Duck. Its hypotarsus is flat and inconspicuous, being marked by three vertical grooves for tendons. The four ridges thus formed graduate in size, the innermost one being the longest and most prominent. The sides of the shaft of this bone are, for the major part, flat, a slight excavation being seen at the upper end of the anterior one.

The trochleæ at the distal extremity are very prominent and well individualized by the deep clefts that severally divide them. They all have median grooves passing around them from before backward. The mid-trochlea is much the lowest of the three, as well as the largest, while the inner one is placed the highest on the shaft, being at the same time turned slightly to the rear. The usual arterial foramen occupies its site, as in other birds.

Agreeing with the group generally, *Spatula* possesses but a feebly developed accessory metatarsal, with a correspondingly weak hallux composed of a basal phalanx and claw, the whole being suspended rather high on the tarso-metatarsal shaft by ligament. This discrepancy in size of the hind toe is likewise seen in the Swans, where it is even still more evident. Second, third, and fourth digits, however, having three, four, and five joints, respectively, are quite the reverse from this, being composed of bones fully in keeping, so far as their size and strength go, with the substantial segments of the limb to which they belong.

Of these joints the basal ones take the lead in point of length, and it is only in the outer podal digit of the Duck where we find that its penultimate phalanx exceeds the joint that precedes it in this particular

NOTES ON A SKULL OF BRANTA CANADENSIS HUTCHINSII.

The characters of the skull as they are seen among the smaller of our American Geese are well exemplified in the subject of these brief comparative notes.

This specimen of *Branta* I collected several years ago on the Platte River, in Wyoming, and prepared it as a skeleton at the time.

I present four figures, giving the four principal views of this Goose's skull of the size of nature. Viewing it from the side, we find a superior osseous mandible of the form I mentioned in the synopsis of characters,

but much shorter than in Ducks and Geese generally. We note here also that a partial septum narium is present, which is absent in *Mergus* and not a constant character among the others.

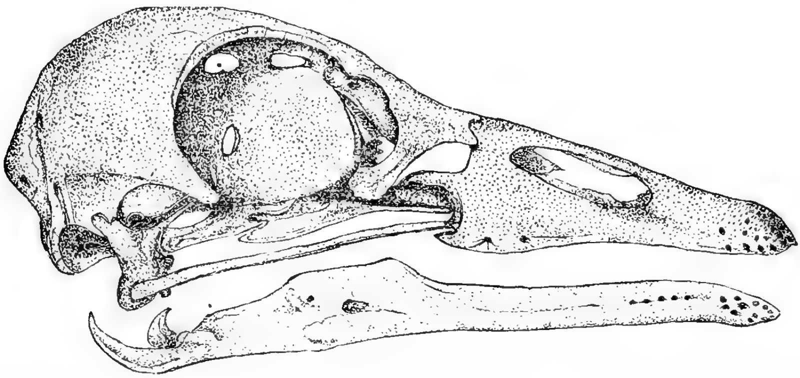


FIG. 27. Skull of *Branta canadensis hutchinsii;* right lateral view; life size. From a specimen in the author's collection.

The lacrymal has the broad descending process, but not so enormously expanded as we find it in the Swans and in *Glaucionetta.* It will also be noted how this tends to approach the sphenotic process of the opposite side of the orbit, which it nearly succeeds in meeting in the Golden Eye.

Again, the condition of the interorbital septum as it is generally formed among the Ducks and Geese is well exemplified in this Goose. Fenestræ occur in the region of the exit of the first pair of nerves, but the center of the plate is impervious. Attention is invited, too, to the form of the palatine, quadrate, and pterygoid on this lateral view.

The crotaphyte fossa is small and inconspicuous, and confined entirely to the side of the head. As in all *Anatidæ*, the entrance to the auricular chamber is thoroughly walled about with bone, without presenting any flaring wing-like extensions as we sometimes see in birds.

The unusual size of the brain-case in Hutchin's Goose is, perhaps, better appreciated upon a direct posterior view than it is here on our lateral one. Comparatively speaking, it is far above, I think, the average for a bird of its size.

Still regarding this skull from the aspect presented, and to make some of its characters still more evident by contrast, we will place it beside the skull of *Mergus*, already described above. We note the difference in the form of the bill; the presence of the cranio-facial line in the Goose, while it is absent in the Merganser. Both have the narrow depressions along the margins of the orbits for the nasal glands, but posterior to this the Goose has the dome-like vault of the cranium so characteristic of the more highly organized types of the *Anatidæ*, while we see that this region in the Merganser is much flattened.

Regarding the skull from the under side, we are particularly to note the difference in form of the maxillo-palatines, the palatine bodies, and the pterygoids.

The vomer varies but little among the genera of this order. When describing it for *Mergus serrator* it was said how its superior border was finished off by a thickened rib. I find in an immature specimen of *Glaucionetta islandica* that the most of this is contributed by the ascending processes of the palatine on either side, each sending a delicate anterior process over the upper margin of the vomerine plate. In mature skulls of Ducks and Geese the sutural traces of this condition of affairs are obliterated, and from an examination of a skull of an adult Duck we would be very much inclined to think that this thickened upper rim of the vomer was a part of its own ossification.

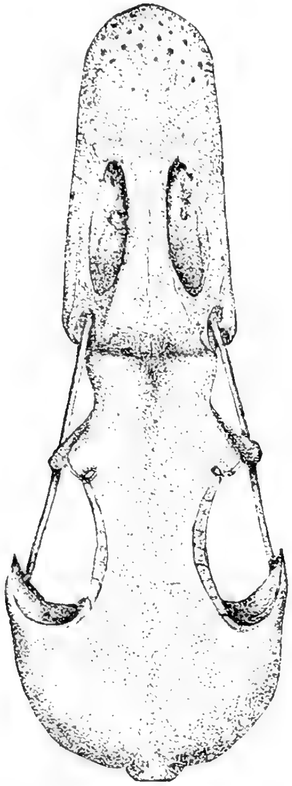


FIG. 28. Skull of *Branta canadensis hutchinsii*; rom above. Same specimen as Fig. 27; life size.

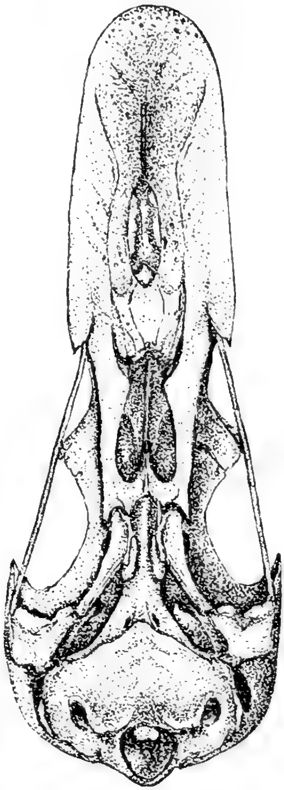


FIG. 29. Skull of *Branta canadensis hutchinsii*; basal view with mandible removed; life size. Same specimen as Figs. 27 and 28.

Seen from behind (Fig. 30), we find the plane of the periphery of the foramen magnum nearly at right angles with the basis-cranii, as in *Mergus*; but the chief feature that strikes us here is, as already alluded to, the great superiority of the Goose over the Merganser in its more capacious brain-case, which, of course, is indicative of the possession on the part of the former of a comparatively and correspondingly much larger encephalic mass.

In comparing the characters of the skull in *Mergus serrator* with the corresponding ones as we find them in the majority of the Ducks, Swans, and Geese, I find them to differ in the following general particulars:

The skull in *Mergus serrator:* Osseous mandibles long and narrow; lacrymo-frontal suture persistent; descending process of lacrymal spine-like; interorbital septum largely deficient at its center; mastoidal head of quadrate single; trochleæ of mandibular foot of quadrate with their long axes placed nearly parallel with the long axis of the skull; maxillo-palatines for their anterior halves meet in the median line, posteriorly they are produced as distinct cylindriform processes with free extremities; pterygoids long, of equal width, and concave outward.

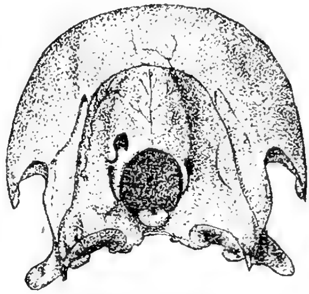


FIG. 30. Posterior view of skull of *Branta canadensis hutchinsii;* mandible removed; life size. Same specimen as Fig. 27 *et seq.*

As a rule, in the skull of Ducks, Swans, and Geese the osseous mandibles vary in length, but are always broad and of a lamellar structure; lacrymo-frontal suture obliterated; descending process of lacrymal much expanded, with flat surface directed outward; interorbital septum very rarely shows a small central vacuity (*Glaucionetta*); mastoidal head of quadrate usually double; trochleæ of mandibular foot of quadrate with their long axes placed nearly at right angles with the long axis of the skull; maxillo-palatines fuse in the median line for their entire lengths, no posterior processes; pterygoids short, straight, and much larger anteriorly than they are at their proximal extremities.

ON THE PROPER NAME OF THE GENUS LABRAX OF CUVIER.

BY THEODORE GILL.

In 1888 Professor D. S. Jordan, in the fifth and last edition of that excellent epitome, "A Manual of the Vertebrate Animals of the Northern United States" (p. 136), has resuscitated the genera *Roccus* and *Morone* for the American Labracinæ, and it was evidently his intention to retain them as genera distinct from their European relations. He has thus reverted to the views promulgated by Gill in 1861. A few words may be in place now as to the proper name of the European genus. *Labrax* can not be used, inasmuch as it had been previously employed by Pallas as well as Cuvier himself* for a genus of north Pacific fishes familiar to all American ichthyologists under the name *Hexagrammus*, and by the European chiefly designated as *Chirus*. In this dilemma, then, another name becomes necessary, and this may be found in *Dicentrarchus*, a designation proposed originally for the *Labrax punctatus* of Geoffroy St. Hilaire under the belief that that species had, as represented, only two anal spines. It has been since shown, however, by Steindachner and others that the character in question was illusive and void, and that the species in reality is a typical *Labrax*, and very closely related to the common *Labrax lupus* of the Mediterranean. The name *Dicentrarchus* thus becomes available for all the European species of the genus, and inasmuch as the term is inappropriate with the etymology which might naturally be attributed to it, it can be interpreted as referring to another feature and be imagined as composed of δις, double (in sense of 2), κεντρον, spine, and αρχος chief, in allusion to the renown and excellence of the fish and to the two kinds of armature or spines which surround the pre-opercular margin and distinguish them from their American relations, as well as the two spines which arm the operculum and on which the genus was especially distinguished from *Perca* by Cuvier. The specific name of the typical species will then be *Dicentrarchus punctatus*.

The external differences between the genera *Roccus* and *Morone* are supplemented by cranial ones, and such are diagnosed by the author in the report on ichthyology in Simpson's Explorations Across the Great Basin of Utah in 1859 (1876, pp. 389, 396).

* Cuvier, Regne animal, v. 2 (1817), p. 268.

OBSERVATIONS UPON THE OSTEOLOGY OF THE ORDER TUBINARES AND STEGANOPODES.

BY DR. R. W. SHUFELDT, U. S. ARMY.

The order *Tubinares* has been made to include the Albatrosses, Fulmars, Shearwaters, and Petrels; the Albatrosses being carried in the family *Diomedeidæ*, and the remaining forms in the family *Procellariidæ*, with such divisions in each into subfamilies and genera as our present knowledge of their structure seems to warrant.

A splendid contribution to the anatomy and classification of the *Tubinares* was left us by my talented friend Mr. W. A. Forbes,* who so ably examined the material for this subject collected by the *Challenger* expedition.

As an introduction to his work, Mr. Forbes gives us a very excellent account of the "Previous Literature on the Anatomy and Classification of the Tubinares," which goes to show that the study of the structure of these birds has by no means been neglected.

My material at the present time is quite limited, although I have at my disposal everything the Smithsonian Institution collections contain. Under these circumstances I can hardly hope to add anything to the exhaustive researches of Forbes, who had at his command alcoholic specimens and skeletons of nearly all the genera known to us. His illustrations, however, are not many, so far as the skeletons of some of the types are concerned, and I am in hopes that this part of my labor will be acceptable to those who may take up the subject in future, and not have at hand, perhaps, some of the skeletons which I have figured to illustrate this memoir.

My remarks will be confined principally to the skull of the adult Albatross, the skeleton of the adult Fulmar, and the skeleton of the adult Gray Fork-tailed Petrel.

Representing the Shearwaters, I have nothing except one sternum of *Puffinus major*, collected by Mr. N. P. Scudder, and an imperfect skull of a Shearwater collected by Dall, which, from its measurements and the locality in which it was picked up (a beach specimen), I take to be *Puffinus tenuirostris*.

I am indebted to Dr. T. H. Bean, of the Smithsonian Institution, for the four fine alcoholic heads of *Diomedea albatrus*, collected by him in

* Report on the Scientific Results of the Voyage of H. M. S. *Challenger* during the years 1873–'76, under the command of Capt. George S. Nares, R. N., F. R. S., and Capt. Tourle Thomson, R. N. Prepared under the superintendence of the late Sir C. Wyville Thomson, Knt., F. R. S., etc., regius professor of natural history in the University of Edinburgh, director of the civilian staff on board, and now of John Murray, F. R. S. E., one of the naturalists of the expedition. Zoölogy, Vol. IV, pt. XI, pp. 1–64; Pls. I–VII (1882).

Alaska. They have been of the greatest service to me. This bird ranges over the Pacific Ocean at large.

Rodgers' Fulmar (*F. glacialis rodgersii*), the skeleton of which we will examine, is confined to the North Pacific. This is likewise the habitat of the Fork-tailed Petrel (*O. furcata*), four nearly perfect skeletons of which bird are found in our list for examination.

Specimens.	Locality.	Collector.	Smithsonian catalogue number.	Remarks.
Diomedea albatrus	Alaska	T. H. Bean	Writer's collection	Alcoholic head.
Diomedea albatrus, juv.	do	do	do	Do.
Do	do	do	do	Do.
Do	do	do	do	Do.
Puffinus major.	Davis' Straits	N. P. Scudder	16976	Sternum, etc.
Fulmarus glacialis	do	do	16978	Do.
Do	do	do	16979	Do.
Do	do	do	16980	Do.
Do	do	do	16981	Do.
Do	North Atlantic	L. Kumlien	16987	Skeleton.
Diomedea albatrus	Cook's Inlet, Alaska	E. P. Herendeen	3333	Sternum.
Diomedea (sp.?)	Oonalaska	Lieut. P.H. Ray	16738	Skull.
Fulmarus glacialis	Upernavick		16781	Skeleton.
Diomedea (sp.?)	Tokio, Japan	P. L. Jouy	16948	Sternum.
Oceanodroma furcata		W. H. Dall	16990	Skeleton.
Do		do	16991	Do.
Do		do	16992	Do.
Do		do	16993	Do.

The skull of the doubtful species of Albatross, No. 16738, from Oonalaska, differs from those in my possession of *D. albatrus*, and probably is some other species, perhaps *D. nigripes* or *Phœbetria fuliginosa*.

The sternum of an Albatross bought by Mr. Jouy in the Tokio market appears to agree very well with specimens of the sternum of the Short-tailed Albatross.

Skeleton of Oceanodroma furcata (Fork-tailed Petrel.)

(Fig. 1.)

We find in the skull of this Petrel some very excellent characters, a number of which it holds in common with the Fulmars, and still fewer with the Albatrosses.

Regarding it from a lateral view, we observe the superior mandible to be powerfully hooked, with the culmen, transversely, very narrow between the longitudinally elliptical osseous nares.

The nasal assumes the holorhinal type, and a concavity appears above, over the region of the cranio-facial junction.

A lacrymal is a very peculiar bone in this bird, it, with a projecting part of the frontal at the superior externo-anterior angle of the orbit, having quite an extensive face that looks directly backward, thus forming a good share of the anterior wall of the orbital cavity. From this portion two processes are sent out; the one reaches directly forward to articulate by its extremity with the hinder free margin of the corresponding nasal. This process forms a wall for the upper part of the rhinal cham-

ber, and may or may not leave a longitudinal, spindle-shaped foramen between its upper margin and the united free upper border of the nasal and frontal. (Fig. 1.)

The remaining process is the descending process of the lachrymal, and it is overlapped posteriorly at its middle by the pars-plana, but reaches the infraorbital bar by the latter being bent at a sharp angle upward to meet it.

This process has a circular foramen in front which leads into its internal cavity, but for which I fail to find an exit or recognize the use of to the bone unless it be a pneumatic opening.

The wing of the ethmoid completely fills in the remainder of the anterior wall for the orbit, being impervious in all its parts. It is separated from its fellow of the opposite side by a median superior area of bone, concave on its posterior aspect. This is the mesethmoid, and is perforated for the passage of the olfactory nerves, the entire wall of the brain-case being open opposite it. It is evident that this latter arrangement gives rise to a large subcircular foramen in each orbital wall at the upper postero superior aspect, through which we may see into the cavity of the brain-case. The optic foramen seems to be intact and perfect in all cases. Beyond it there is another circular foramen about the same size, which pierces the interorbital septum here—really a concavity between the sloping walls of the pars-plana on one hand and the lower portion of the anterior wall of the brain-case on the other.

The *quadrate* has a form much the same as in birds generally, but the mandibular facets at its foot are characteristic. The outer and oblong one is placed obliquely, its anterior end being forward; the inner and lower one, in addition to a facet which it has placed nearly in the horizontal plane, has another which looks almost directly forward. This latter one is transversely grooved for its entire length. Viewing this skull from above, we find it marked by a shallow, median groove, being deepest between the orbits.

The luniform, supraorbital, glandular depressions occupy the entire upper free margins of these cavities, extending between the lacrymals and upturned, pointed post-frontals. They are clean-cut and deep, being of about an equal width throughout.

Posteriorly the skull is smooth and rounded, in direct continuation of a similar character of surface of the parietal region. It lacks all those angular definitions of areas so prominent in the *Alcidæ* and *Urinatoridæ*.

The crotaphyte fossæ are lateral and very feebly pronounced. Seen upon its under side, we at once discover that the skull of this Petrel presents all the characters of a veritable Cecomorph, which it is. The arrangement of the bones of the hard palate is essentially the same as in the Loons, Auks, and Guillemots. We notice here, however, that in this Petrel the palatines each present a convexity toward each other opposite where they meet the maxillo-palatines. These latter are thin, firm plates of bone arranged as in the Auks or Gulls, with the excep-

tion that their median free margins seem to anchylos with the corresponding edges of the palatines over which they lay; consequently upon this view they are shut out of sight and do not appear in the interpalatine space.

The *vomer* is very long, being half a hollow cylinder behind, with its convex surface downward; the posterior end of this joins the palatines in the usual way. Below, it is longitudinally grooved in the median line. This groove is continued forward as a carination on the anterior portion, to terminate in a little spike in front. The concavity of the half cylinder and the anterior portion form together a long gutter for the rostrum of the sphenoid.

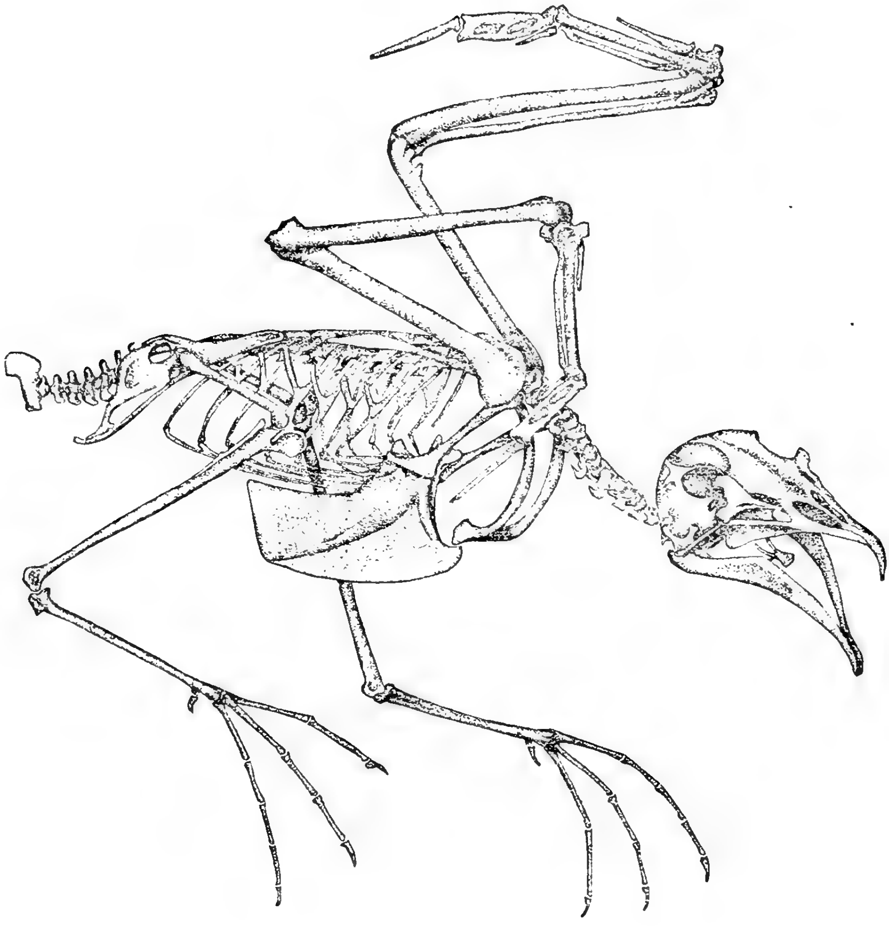


FIG. 1. Complete skeleton of *Oceanodroma furcata*. (Specimen 16990, Smithsonian collection.) Life size. By the author.

The *pterygoids* are slender, straight bones; their anterior heads meet each other and the heads of the palatines, the four forming a groove above for the under convex surface of the presphenoidal rostrum.

There is no sign whatever of the presence of basi pterygoid processes. Huxley mentions their occurrence in *Procellaria gigantea* in his Classification of Birds.

The Eustachian tubes seem to have a common aperture, and the external opening is nearly naked.

Behind this orifice the basi-temporal region is represented by a broad area, which, in common with the margins of the subcircular foramen magnum and the small hemispherical and sessile condyle, is in the horizontal plane.

An upper view of the mandible shows it to be perfectly V-shaped, with rather a short, longitudinally grooved symphysis. Its anterior apex is at the intersection of the lower ramal borders, which are straight lines, while the superior borders, forming as they do the sides of the symphysial groove above, become gently convex and approach each other to meet in this apex below. The anterior end of the mandible in an Albatross is shaped in much the same manner.

The side of each ramus is broad from above downward just beyond the feebly pronounced coronoid process. Beyond this the upper and lower borders are nearly parallel, and the space they include quite narrow.

A mandibular end is triangular in outline with the apex below, and the plane of its area making but a slight angle with the plane in which the inferior ramal borders are found.

The original elements of this lower jaw are completely united together, leaving scarcely any trace of their original margins or a ramal vacuity where it usually occurs in many birds.

For the rest the bone is pneumatic, the foramina being at their usual sites, upon the inturned processes of the articular ends.

Petrels have a broad first basi-branchial in their *hyoid arches*, which co-ossifies with a spine-like second basi-branchial.

The cerato-hyals and glosso-hyal never form in bone, while the second arches are exceedingly delicate osseous threads in *Oceanodroma*, curving up behind the occiput in the usual fashion of the class; these "greater cornua" being composed of the common elements and articulated in the common way.

Of the vertebral column, etc.—Usually in this Petrel the first free pair of tiny ribs occur upon the fourteenth vertebra of the column, but in one of these specimens they are liberated also on the thirteenth. In either event, however, there is a long, delicate free pair suspended from the fifteenth vertebra.

Neural spines occur upon the second to the sixth, inclusive, but are from thence onward suppressed until this feature makes its appearance again in the fourteenth vertebra. The hyapophysial canal is found in the sixth, seventh, and eighth, but thereafter a process is found all the way through the series to the sacrum. These hyapophysial processes are quite prominent in mid-dorsal region. Here, too, the neural spines are very intimately connected together, but nevertheless the vertebræ are all movable upon one another.

From the sixteenth to the twenty-first vertebra, inclusive, we find a

March 26, 1889.

series of true ribs occurring, connected to the sternum by costal ribs. They support anchylosed epipleural appendages, which may lap two ribs in the middle of the series.

A delicate pair of ribs also spring from beneath the ilia, but their hæmapophyses do not reach the costal borders of the sternum.

These dorsal vertebræ are almost entirely devoid of metapophyses or interlacing spiculæ above. Their articulations are heterocœlous, and they are non-pneumatic throughout the series.

In the *pelvis* the anterior ends of the ilia are truncate from before backward, and their inner margins do not usually meet the neural crest of the sacrum, leaving, in consequence, "ilio-neural grooves" at their sides. These bones are narrow, of nearly an equal width, and concave in both directions. They rise over the acetabula, on either side, to form small convex areas to the rear and above these cavities. Below this the remainder of each ilium, aided by the corresponding ischium, form the drooping sides of the pelvis so characteristic of the Petrels

Each ischium has a posterior process, which, after forming the superior boundary to the obturator space, curves downward to become an expanded, foot-shaped end, which closes in the aforesaid space by having the lower margin of the foot applied to the upper margin of the post-pubis.

The ischiatic foramen is nearly circular and, in common with the acetabulum, rather small.

There is no pro-pubis in this Fork-tailed Petrel, and the obturator foramen and space, as a rule, form one vacuity.

Eight spreading caudal vertebræ, with a quadrilateral pygostyle, make up the skeleton of the tail. There appear to be many more of these segments, as the united uro-sacral vertebræ beyond them seem to continue the series so perfectly. This is still more striking in *Fulmarus*.

Of the sternum and pectoral arch.—The furcula is of the U-shaped variety, and curved backward toward the sternum, its quadrate hypocleidium having its lower border usually in contact with the upper border of the protruding carinal angle.

The clavicular limbs are about of an equal width throughout, the posterior tips of their heads becoming pointed, and in articulation meet the scapular heads at their inner angles. The outer aspect of each of these heads of the clavicular limbs are modeled so as to form an extensive concave facet for the head of the corresponding coracoid. This arrangement is not seen in the Albatrosses nor Fulmars.

A *coracoid* is principally notable for its greatly expanded sternal end, the outer angle of which is much produced.

Its shaft is subcylindrical and its head tuberous. The scapular process descends upon the inner side of the shaft, but, so far as I can see, is not pierced by any foramen, as it is in the Fulmars and *Diomedea*.

A *scapula* is dilated posteriorly and truncate after the manner most

common to birds; its head is rather broad and compressed from above downward.

The entire pectoral arch is non-pneumatic, in keeping with the most of the rest of the skeleton.

The body of the sternum in *Oceanodroma* is of a square outline, with its postero-lateral angles slightly produced and its xiphoidal border entire. Above it is concave, being correspondingly convex upon its pectoral aspect. The carina is deep in front and gradually slopes to the mid-point of the hinder border of the sternal body. Its angle protrudes and its anterior margin is concave.

Each costal border has six articular facets upon it, and the costal processes are triangular in outline and quite prominent. The manubrium is wedge-shaped and small, and the coracoidal grooves nearly or quite meet at its base.

The chief pectoral muscular line starts from a point on the lower lip of a coracoidal groove half way between the manubrium and costal border, to be produced posteriorly and terminate at the junction of hinder and middle thirds of the line made by the carina where it joins the sternal body. This bone is non-pneumatic.

Of the appendicular skeleton.—When closed in a position of rest the bones of the antibrachium rather exceed in length the humerus, and both are long for the size of the bird.

The shaft of the latter bone is subcylindrical and nearly straight, viewed from any aspect. Curling, as it does, far over the pseudo-pneumatic fossa, the ulnar crest forms a prominent feature at the proximal end of the bone. Another and smaller fossa, protected somewhat in a similar manner by the overhanging humeral head, is separated from the former by a bony bridge.

The radial crest is short, but well pronounced, with its free border convex.

At the distal extremity of the humerus we notice a conspicuous ectocondyloid process, and to its inner side at the base of the shaft, beyond the trochlear tubercles, a deep pit.

The anconal aspect of this extremity is profoundly marked by a median tendinal groove. The bone is about 3.5 centimeters long.

After very careful search at the elbows of all four of these specimens of *Oceanodroma furcata* I fail to find the slightest trace of anything like a sesamoid bone, and the specimens are in a condition, too, that if they existed they would more than likely be there.

I am aware of the existence of Reinhardt's paper upon this subject, but it is not at the present writing available to me, and I can not say whether he claims to have found these sesamoids in *Oceanodroma* or not.

The shaft of *radius* is very straight and that of the *ulna* not much bowed, so we have a small interosseous space in this Petrel.

The skeleton of manus is long (4.5^{cm}), but does not call for special remark beyond the fact that pollex digit does not bear a claw, nor does

the distal phalanx of index in the specimens, although the latter under the microscope seems to have a facet there for that purpose.

The expanded phalanx above this one is not perforated (Fig. 1), as it so often is in the *Laridæ*. The limbs of this skeleton are non-pneumatic.

In the pelvic extremity the *femur* is comparatively short, its average length being 1.5^{cm}, the tibio-tarsus measuring 3.8^{cm}, and the tarso-metatarsus 2.5^{cm}. The femoral shaft is cylindrical and slightly arched forward. Its trochanterian ridge is suppressed, being on a level with the summit of the bone, while its head is quite sessile and excavated for the round ligament. Distally its condyles are proportionately developed, the outer one being rather the lower of the two.

Tibio-tarsus also has quite a straight and smooth shaft, presenting all the characters as commonly seen in the majority of the class. Its own special character, however, which its owner seems to hold in common with the family, consists in a marked prominence of the procnemial ridge over the nearly aborted ectocnemial ridge. Neither of these extend for any distance down the shaft, but are, on the contrary, directed equally upward and forward in rather a striking manner.

I have failed to discover the presence of a *patella* in this Petrel, but from the fact that this sesamoid occurs among the Fulmars—birds with a tibia very much like our present subject—I think we are justified in believing that perhaps a very minute one is to be found in the tendon. This latter has been scraped away in every instance by the preparator, whereas the tendons at the elbow were allowed to remain.

The *fibula* is extremely short and delicately constructed, extending but a very short distance below its ridge on the side of the other leg-bone.

Hypotarsus of the next segment of this extremity seems to have but a single median groove at its posterior aspect for the guidance of tendons. This is continued for the entire length of the shaft behind, becoming more faintly marked as we descend the bone, while anteriorly this longitudinal groove is strongly marked.

The first metatarsal is a diminutive bone, attached to the side of the main shaft at its usual site by ligament. It has articulating with it the ungual joint, the basal one never appearing in these birds. Of the distal trochleæ the inner one is the most elevated and at the same time most posterior.

The podal joints of the anterior toes are extremely long and delicate, but otherwise arranged upon the plan most common to the avian foot.

BRIEF SUMMARY OF THE OSTEOLOGICAL CHARACTERS OF OCEANODROMA FURCATA.

(1) Superior osseous mandible powerfully hooked; culmen convex; nasal holorhinal; lacrymal with long, anterior process, which extends forward to the nasal; maxillo-jugal bar bent at an angle upward to meet descending process of lacrymal.

(2) Ethmoid peculiarly bulky and pierced by the olfactories. Crotaphyte fossæ lateral; maxillo-palatines do not encroach upon the interpalatine space. As negative characters: Basipterygoid processes not present; angle of mandible truncate (no processes); no ramal vacuity.

(3) Sternal end of coracoid much produced laterally and externally. Hypocleidium of furcula in contact when articulated with anterior margin of carina of the sternum.

(4) Xiphoidal end of sternum a transverse straight line, neither fenestrated nor notched; carina deep in front, occupies entire length of sternal body.

(5) Humerus possesses an ectocondyloid process, and is shorter than the skeleton of antibrachium.

(6) Accessory metatarsal is free and articulates with ungual joint of hallux, the basal one not appearing.

THE SKELETON IN THE FULMARS (FULMARUS GLACIALIS RODGERSII).

There are but a few unimportant differences between the skeleton of Rodgers' Fulmar and *F. glacialis*, and I prefer to confine myself to the discussion of the former bird in my description of the osteological characters of those well-known representatives of the order *Tubinares.* Moreover, as they possess not a few characters in common with *Oceanodroma*, I feel at liberty to make this description rather a comparative one than otherwise, as my account of the osteological characters of the latter form is quite full; thus my labor will be lessened, and I know the result will be of more value and greater use.

The superior mandible in the skull of Rodgers' Fulmar is large and massive; its posterior two-thirds is convex, while a smaller median convexity is engrafted upon its anterior end, which is produced downward in a powerful hook.

The margins are likewise gently convex and cultrate. Each narial aperture is spindle-formed and the nasal is of the holorhinal type, its two processes being wide and thoroughly incorporated with the surrounding bones.

We find the lacrymal constructed upon the same principle as in the Fork-tailed Petrel, though the upper margin of the anterior process unites with the frontal and nasal above it. Then the pars-plana and the body of the bone have also merged into each other, leaving us in doubt as to the exact locality of the suture. The arrangement of the parts at the inner aspect of the orbital cavity is as in *Oceanodroma,* but we observe that foramina occurs over the ethmoidal wings, while the perforation is comparatively larger and, in fact, absorbs all that part of the bone entitled to such a name. The maxillo-jugal bar is not bent up to meet the lacrymal, and the quadrate is the same as in the Petrels.

Jutting out prominently from the sides each sphenotic process is of a quadrilateral outline, and a ridge upon their posterior aspects divide

either supraorbital glandular depression from the corresponding crotaphyte fossa.

Regarding this skull from above, we are to note how profoundly it is impressed by the glandular pits; that they do not meet in the median line, and, further, that their position agrees precisely with what we found in *Oceanodroma*. A shallow, median groove here marks the skull, the remainder of which is smooth and globular. Viewed from behind, the peculiar form and position of the deep crotaphyte fossæ forces itself upon us, and the jutting sphenotic processes come directly into view. Underneath, the skull presents us with many points of interest.

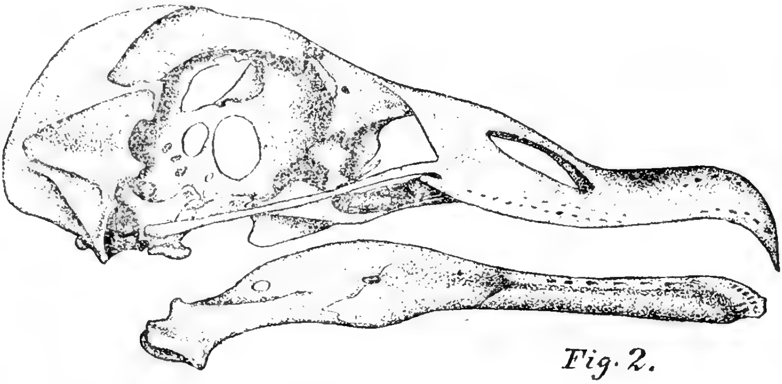


Fig. 2.

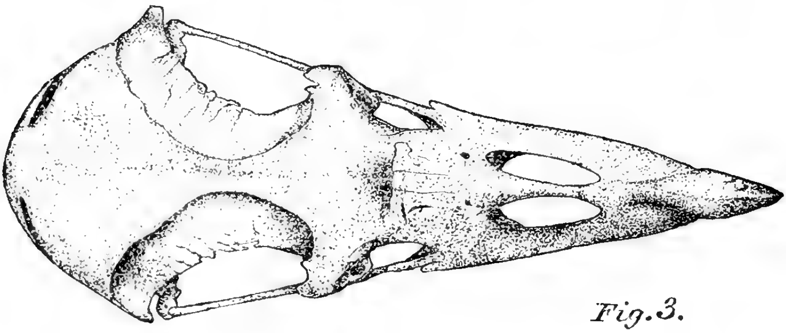


Fig. 3.

Fig. 2. Right lateral view of the skull of *Fulmarus glacialis rodgersii*, ♂.

Fig. 3. Same form above, mandible removed. Both figures drawn by the author from specimen 12613 of the Smithsonian collection. Life size.

The superior mandible is canoe-shaped, with its prow to the front, and its deep concavity extending to the rear.

The maxillo-palatines are elliptical disks tilted up as in the *Laridæ*, and encroaching for their entire inner margins upon the interpalatine space, where they are well separated from and parallel to each other.

Of extraordinary size, the *vomer* (Fig. 6) in this Fulmar is of an elongated, cordate form, nearly flat, being slightly concave above; carinated in the median line beneath, with its anterior tip somewhat depressed; and, finally, meeting the palatines behind as usual, these latter bones have to curl to one side to clear it laterally, for this vomer forms a very complete floor to the rhinal chamber without coming in contact with its neighbors.

Well over this vomer, in the median line, the rostrum is extended as a long spiculiform process. The anterior ethmoidal margin is sharp, but becomes broad as the bone abuts against the region of the craniofacial hinge. Beyond this it is sometimes extended as a semiosseous median supero-rhinal septum.

The palatines are also unusually broad, their postero-external angles being well rounded off. Laterally they are quite horizontal, but each inner margin, just beyond the palatine heads, is turned down for a short distance as a prominent inner carination.

Thoroughly developed *basi-pterygoid* processes meet to articulate with others coming from the pterygoid bones themselves. Huxley found those present also in the Giant Fulmar, and I have reason to suspect their presence in the Shearwaters (*Puffinus*).

In Rodgers' Fulmar the occipital condyle is hemispherical in form, and the outline of the foramen magnum subcircular.

I regret to say that I can offer nothing upon the *hyoid arches* of this Fulmar, as that part of the skeleton has been lost in all the specimens.

In the *mandible* the symphysis is short and sunken between the convex ramal walls. It protrudes slightly in front as a blunt process.

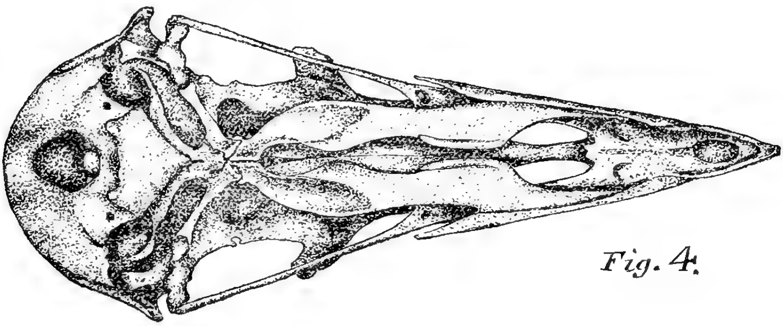


Fig. 4.

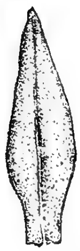


Fig. 6.

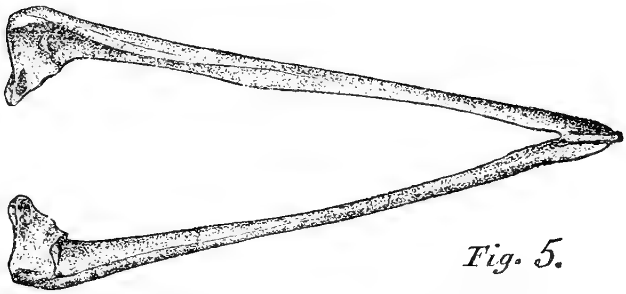


Fig. 5.

FIG. 4. Basal view of the skull of *Fulmarus glacialis rodgersii*; mandible removed.

FIG. 5. Mandible of the same specimen, viewed from above.

FIG. 6. The vomer of the same, from above. All these figures are life size, and drawn by the author from specimen 12613 of the Smithsonian collection.

Both superior and inferior borders of the bone are rounded and the coronoid processes very feebly developed.

Each surangular is pierced by an elliptical foramen, but the true ramal vacuity is covered over by the extended growth of the mandibular elements.

The angles are truncate, slightly produced below, and the articular cups show on their upper sides at the usual sites the large pneumatic foramen on either one. Much of the skull proper is likewise permeated by air.

Of the vertebral column and the rest of axial skeleton.—What I have said of the vertebral column of *Oceanodroma* applies almost exactly to the column in this Fulmar; the twenty first vertebra, however, in both the common *Fulmarus* and *F. rodgersii* anchyloses as the anterior one of that series which goes to form the sacrum between the pelvic bones. Its ribs in consequence meet a pair of costal ribs below, that in their turn articulate with the sternum.

Rodgers' Fulmar has the hyapophysial canal of the cervical series passing through the sixth to the tenth vertebra, inclusive.

Moreover, in the dorsal region we find this bird differs from the Petrel in having fully developed metapophyses linking the outer ends of the transverse processes together.

The eleventh, twelfth, and thirteenth vertebræ all have a large, single hypapophysis. This is not so long, and has lateral, basic processes in the next two, while through the dorsal series it becomes gradually longer, then shortens again, to appear for the last time as a minute point on the first sacral. From the second to the fourth, inclusive, the cervical vertebræ not only have these hypapophyses, but equally well-developed neural spines. The latter gradually disappear in the next two, and the arterial canal supplants the former.

The skeleton of the trunk of *Fulmarus glacialis*, from the specimen collected in the North Atlantic by Ludwig Kumlien in 1877, has been allowed to remain nicely articulated, with all the bones in their normal positions. In it the sternum is very short and concave, while the six vertebral ribs descend almost directly to reach the costal ones, and other particulars are observed in which it agrees with *F. rodgersii.*

Epipleural appendages which belong to the ribs of this Fulmar anchylos with their borders, and never overlap more than the next succeeding rib behind them.

Occasionally among the vertebræ we will find one that shows a pneumatic foramen, but I believe the ribs are solid, and air does not gain access to the interior of any of them. Sometimes in the last pair of sacral ribs one or the other may be but feebly developed and not have any free hæmapophysis to meet it below. Such is the case in the skeleton of Rodgers' Fulmar before me.

Kinship with the Albatross unmistakably crops out in the *sternum* of this bird. A glance at the figures is enough to satisfy one of this fact.

In outline the bone is quite square, and although in some specimens the xiphoidal border is, like in the one I figure, jagged to an extent that leads us to believe it to be without any regular pattern, I have, nevertheless, sufficient material before me to prove that the tendency of the bone is to become doubly notched.

Above, it is very concave, accompanied of course by a corresponding convexity of the pectoral aspect. It is upon this latter that we notice that the muscular line meets the base of the keel at junction of middle and *anterior* third, differing considerably from *Oceanodroma* in this respect.

The carina is deep in front and gradually slopes away to the posterior margin. Its anterior border is broad and straight, being deeply grooved from above downward. The angle stands out quite prominently and

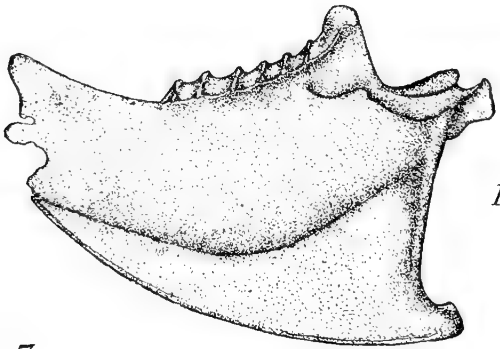


Fig. 8.

Fig. 7

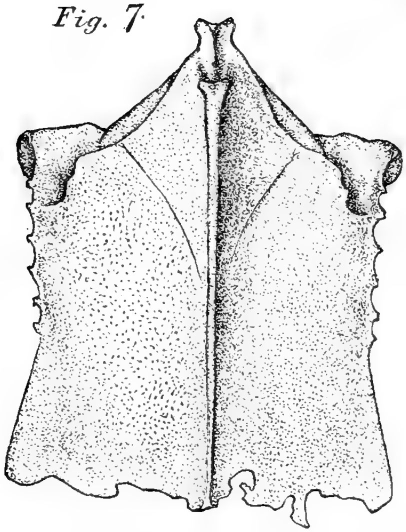


Fig. 9.

FIG. 7. Inferior view of the sternum of *Fulmarus glacialis rodgersii*. Life size.

FIG. 8. The same bone; right lateral view.

FIG. 9. Direct anterior aspect of right coracoid and scapula. Same specimen. All life size. Drawn by the author from specimen 12613 of the Smithsonian collection.

may have its end truncate and thickened. Each costal border is very wide from side to side, and supports the six prominent, regularly arranged facets for the costal ribs.

There are no pneumatic foramina to be seen among them. Indeed, this is one of the differences between this bone and the sternum of an Albatross, which is thoroughly permeated by air cavities. The anterior border, between the rather lofty costal processes, is bent forward at an angle, the apex of which supports below the trihedral manubrium.

The coracoidal grooves are long and shallow, meeting mesiad at the manubrial base and having a lip of bone at their externo-inferior borders to hold each coracoid in position when articulated.

As in the sternum just described, the elements of the *pectoral arch* or shoulder-girdle are non-pneumatic, and, in consequence, proportionately heavy.

The *furcula* when articulated differs from that of the Petrel in not reaching the anterior border of the sternum. Viewed from in front we find it to be of the U-shaped style, with the limbs of nearly uniform caliber throughout.

In articulation the pointed clavicular heads merely rest against the inner aspect of each coracoidal summit, while their tips overlap the antero-median angle of either scapular head. Thus the tendinal canal is completely closed in among the three bones.

This furcula has no hypocleidium, but the arch is considerably thickened at its usual site.

A *coracoid* has a large tuberous head, which is bent forward and toward the median line. The scapular process is very extensive, being carried well down upon the antero-posteriorly compressed shaft. I believe it will always be found to be pierced by the foramen. The coracoid of this Fulmar acquires a very unique form from the extraordinary manner in which the infero lateral angle of its sternal extremity is produced. This is even more striking than we found it in the Petrel.

The head of a *scapula* is broad transversely and somewhat compressed from above downward. It offers about the usual amount of articular surface for the glenoid cavity, and when *in situ* its anterior border occupies the entire superior line of the scapular process of the corresponding coracoid.

The blade of the bone is comparatively short and gently arches over the ribs in the usual manner. Its anterior two-thirds is narrow and thickened, while its hinder extremity is slightly dilated and its tip rounded off.

These characters of the shoulder-girdle, as I have given them, agree in the five or six specimens before me, and I have intentionally omitted any slight deviation due to individual peculiarity.

Of the pelvis and caudal vertebræ.—As already mentioned above, the anterior vertebra of the pelvic sacrum extends beyond the iliac bones (Figs. 10 and 11), and its neural spine is indistinguishably anchylosed with that of the next one behind it, and so on to a point opposite the acetabulæ, where this neural crest is suppressed, and the rim that surmounts it for its entire length merges into the flattened neural arches of the next three or four vertebræ. Both at this point, and still more so behind, these sacral vertebræ are unusually well individualized, so that the skeleton of the tail seems to really begin between the cotyloid cavities. Usually, however, eleven or twelve are anchylosed in the "sacrum" and eight or nine are free and constitute the tail, in addition to the terminal pygostyle.

As a rule the anterior portion of each ilium is depressed below the neural crest of the united sacral vertebræ, having "ilio-neural" canals to their inner sides. Each anterior iliac border is truncate, thin, faintly emarginated, and sometimes unevenly serrated, while the blade of the bone is concave from before backward, as well as from side to side, and contracts slightly before reaching the cotyloid cavity.

Upon the under sides six vertebræ throw out their processes against them, and both pairs of sacral ribs may become anchylosed, though usually the anterior pair remain free, connecting with the sternum by costal ribs.

The seventh vertebra of the sacrum is the only one where the lateral apophyses are reduced. It is immediately opposite the acetabula.

From the eighth, inclusive, and on, however, the pleur- and par-apophyses regularly graduate into the form they assume in the true caudals, their processes being very nearly of an equal length and their extremities abutting against the free inner margins of the ilia.

So really, from an under view, the sacral and caudal series of vertebræ have all the appearance of a gradually modified chain of bones from the last dorsal; in short, a tail with the pelvic bones simply pressed against its sides to become anchylosed there.

The post-acetabular area of either ilium is very narrow and gradually becomes reduced to a point behind, the surfaces turning toward each other as we proceed in that direction, being bounded externally by a raised border. This latter extends between the apex of each antitrochanter to the aforesaid point behind, where the ilia terminate posteriorly on either side.

From this line and downward the sides of the pelvis are formed behind by the remainder of each ilium, an ischium and a post-pubis.

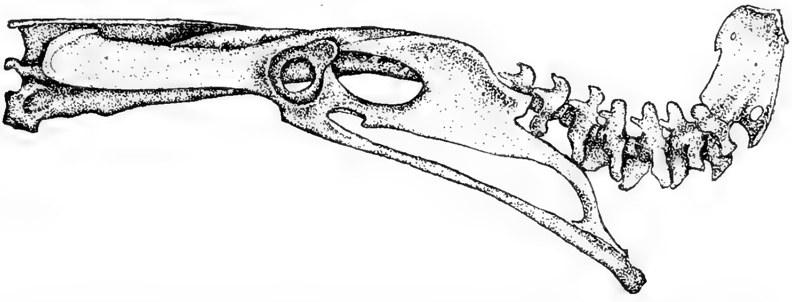


FIG. 10. Left lateral view of the pelvis and coccygeal vertebræ of *Fulmarus glacialis rodgersii*, ♂. Life size. By the author. (Specimen 12613, Smithsonian collection.)

These surfaces look almost directly outward and only slightly upward. Each presents for our inspection the large subelliptical ischiatic foramen, the cotyloid cavity, and antitrochanter; and the obturator foramen, which here has almost entirely merged into the extensive and long, oval obturator space, closed in behind, as in the Petrels, by the peculiarly formed foot-like process of the hinder end of the ischium.

Just the faintest trace of a pro-pubis is seen in the pelvis of this Fulmar, while the post-pubis is narrow, nearly straight, slightly expanded behind where its upper edge meets the aforesaid process of the ischium, beyond which it soon terminates in a square-cut end that in life is produced in a cartilage of an equal width for a short distance farther.

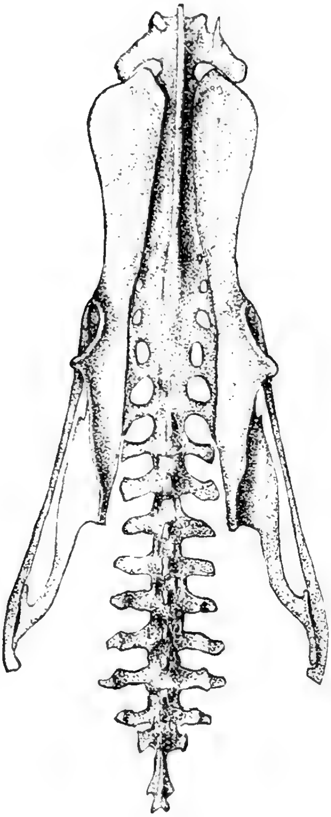


FIG. 11. The pelvis of *Fulmarus glacialis rodgersii*, seen from above. Same specimen as shown in Fig. 10. Life size. By the author.

The *caudal vertebræ* are all supplied with chevron bones, except the first two or three anterior ones. They become progressively larger from before backward, and are all bifid, being profoundly cleft in an antero-posterior direction. This is continued to the lower angle of the pygostyle, where it is represented in most specimens by a notch.

These chevron bones are anchylosed to the vertebræ over which they stand, and their bases are produced in front so as to encroach slightly upon the segment next in front of them, when the series is articulated *in situ*.

The pygostyle is a large quadrate bone, with sharpened anterior border, but thickened behind. A clean, circular foramen is generally to be found at its infero-posterior angle, indicating the point of union of the two anterior vertebræ that compose this compound bone, it being a vacuity between their chevron bones.

Of the appendicular skeleton.—We find that both the pectoral and pelvic limbs in the Fulmars are non-pneumatic, and much animal matter is contained in the large cavities of the long bones composing them.

When the skeleton of the pectoral limb is closed alongside the body *in situ* the bones of the antibrachium are but very slightly in advance of the humerus, the ulna being nearly of a length with that bone and the radius slightly longer.

The shafts of these long bones are all notably straight, that of the humerus being subcylindrical on section and showing scarcely any curvature viewed from either aspect.

The head of the *humerus* is fashioned as we found it in the Petrels, but the radial crest is more prominent and of a triangular form. Its distal extremity supports a large ectocondyloid process, between which and the opposite border, on the palmar aspect, a conspicuous concavity exists, as described for *Oceanodroma*.

Rodgers' Fulmar, as far as I can learn from the excellent material before me, is devoid of any such thing as sesamoids about the elbow-

joint, and this of course applies to the common Fulmar, of which there is an excellent ligamentous skeleton at hand.

The shaft of the *ulna* shows faintly the row of osseous papillæ for the quill-butts of the secondaries. So straight is the shaft of the *radius* that scarcely any interosseous space occurs between these antibrachial bones; such as it is, however, is long and narrow, extending between the shafts for their full length.

Carpus is composed of the two usual segments, and *carpo-metacarpus* is formed much as we find it in the *Laridæ*. Pollex phalanx and the distal phalanx of the index are slender and subtrihedral and both strikingly long.

The expanded portion of the proximal joint of index digit is not perforated, as in many Gulls, and the small joint next to it is about half as long.

Excepting the great difference in size the pelvic limb of this Fulmar nearly agrees with the pelvic limb of *Oceanodroma*. We observe that the head of the femur is very much scooped out for the ligamentuum teres and that the muscular lines mark its shaft pretty well. The patella and oddly-shaped head of tibio-tarsus I have already figured elsewhere. (Proc. U. S. Nat. Mus., 1883, Vol. VI, p. 329, Fig. 5.) I know of no bird where the suppression of the ectocnemial ridge at the proximal end of the bone and the high development of the procnemial ridge is better shown.

The *fibula* is almost thread-like below its middle articulation with the greater leg-bone, and its lower extremity anchyloses with its shaft.

In the *tarso-metatarsus* the hypotarsus is doubly grooved behind, but otherwise the arrangement of the accessory metatarsal and podal digits is essentially the same as described for the Petrels.

OSTEOLOGICAL POINTS WHEREIN OCEANODROMA FURCATA AND FULMARUS GLACIALIS RODGERSII DIFFER.

1. *Oceanodroma.*—Maxillo-jugal bar bent upward at an angle to meet the descending process of lacrymal.

1. *Fulmarus.*—Maxillo-jugal bar nearly straight.

2. *Oceanodroma.*—Crotaphyte fossæ lateral, feebly impressed, not produced to meet the occipital prominence behind.

2. *Fulmarus.*—Crotaphyte fossæ extended to the posterior aspect and upon the occipital prominence; deeply impressed.

3. *Oceanodroma.*—Maxillo-palatines do not encroach upon the interpalatine space. Vomer long and narrow, hinder half concave above, correspondingly convex below and longitudinally grooved; anterior half carinated below, pointed in front and its concavity above continuous with that of the posterior half.

3. *Fulmarus.*—Maxillo-palatines do encroach upon the interpalatine space. Vomer very large, nearly flat, broad, and general outline elongo-cordate.

4. *Oceanodroma.*—Basi-pterygoid processes entirely absent.

4. *Fulmarus.*—Basi-pterygoid processes present and thoroughly developed, articulating with pterygoids.

5. *Oceanodroma.*—Anterior tip of mandibular symphysis at the intersection of the right lines forming the inferior ramal borders. Surangular entire.

5. *Fulmarus.*—Anterior tip of mandibular symphysis produced directly with its protruding process squarely cut across. Surangular pierced by a foramen.

6. *Oceanodroma.*—Twenty-first vertebra of the spinal column free. Xiphoidal extremity of sternum entire, its hinder border a transverse, straight line.

6. *Fulmarus.*—Twenty-first vertebra of the spinal column anchyloses with the pelvic sacrum. Xiphoidal end of sternum not entire, its hinder border jagged with an evident predisposition to become two-notched.

NOTES UPON SPECIMEN NO. 3618, SUPPOSED TO BE A SKULL OF PUFFINUS TENUIROSTRIS, AND OTHER MATERIAL.

It will be impossible for me to state positively as to what manner of bird the skull No. 3618 of the tabulated list of material belonged, but there is some reason to believe it to be that of a Shearwater. It is evidently a specimen that has been picked up on the beach, and was collected by Professor Dall at Oonalaska. Its basal points have been much broken and all the small free bones lost. As I have already said, my measurements of the specimen lead me to think that it is the skull of *P. tenuirostris* and from an adult bird.

The superior mandible is upon the same type as *Fulmarus*, though much modified. The supraorbital glandular depressions meet for a short distance in the median line.

The base of the orbit and surrounding parts are much as we find them in the Petrels and Fulmars, but the optic foramen and the foramen in the interorbital septum have run into one. *Basi-pterygoidal facets are present at the base of the rostrum.*

The erotaphyte fossæ are broad and deep, and meet the sides of the supraoccipital prominence, to be produced to some extent from either side upon its dome.

The foramen magnum is unusually large.

In *Puffinus major* the pectoral arch and sternum has the general form of the like parts in *Fulmarus rodgersii*, but differs from them in having the furcula meet the carina of the sternum when articulated in life; in having the sternum a pneumatic bone, as in the Albatrosses; in the sternal body being comparatively longer; and in having its xiphoidal border two-notched and convex forward.

OBSERVATIONS UPON THE OSTEOLOGY OF DIOMEDEA ALBATRUS.

Although made largely upon the characters presented by the osseous parts of the roof of their mouths, Huxley's remark, in his Classification of Birds, that the *Procellariidæ* were aberrant forms and inclined to

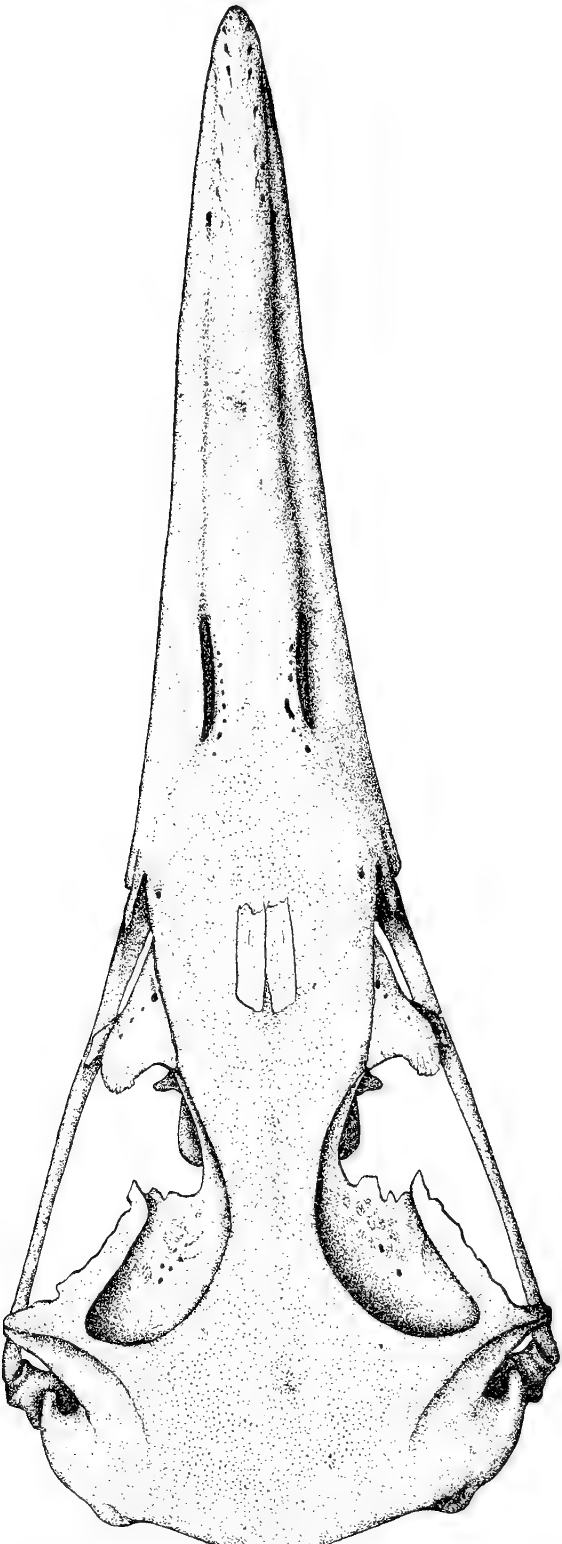


FIG. 12. Skull of *Diomedea albatrus*, viewed from above, with mandible removed. Drawn by the author from an Alaskan specimen presented him by Dr. T. H. Bean. Slightly reduced.

ward the Pelicans and Cormorants, when we come to compare the skulls of the various forms referred to by that writer this statement will be seen to have a large measure of truth in it. The points he calls attention to are very well shown in the figures he presents us in his well-known paper of *Procellaria gigantea* and *Diomedea exulans* (P. Z. S., 1867, p. 431, Figs. 12 and 13).

In this particular instance I believe that this opinion of Professor Huxley will some day be verified, or just so soon as we become better acquainted with the entire structure of a number of the forms now supposed to be related. Anatomists have amply demonstrated during the past few years that this single character—the condition of the bones at the roof of the mouth—can not invariably be relied upon, and we must always look into and compare other structures if we wish to correctly judge of the true affinities of birds. The teachings of the law of evolution call for this above everything else that I know of, as we there learn how one such character may be retained while many others in the same organization may go on varying for ages.

In the skull of the Albatross we see the Pelican in its posterior view; we see the Petrel; we see the Cormorant and Gannet foreshadowed in its palatines; we see the Fulmar, and we catch glimpses of the Gull; yet how hard it would be to put your finger upon the predominant type.

Upon lateral view we have the powerful superior mandible, with its terminal, decurved, and massive hook. Its culmen is roundly convex and its dentary borders are cultrate, the dentary processes behind being thrown down from beneath these lateral edges to meet the palatines below them and to their inner sides. Each nasal has been thoroughly absorbed in the adult, robbed of its individuality, and made to fulfill its part in the creation of this form of skull.

No nasal septum is present, and the bony nostrils are comparatively small and quite elliptical in outline. From the anterior arc of each, upon the lateral aspect of this upper mandible, either side, a shallow, longitudinal groove is carried forward, to merge into the dentary edge at the commencement of the mandibular hook. A *lacrymal* is a highly pneumatic, freely articulated, bone, its descending process meeting the straight maxillo-jugal bar, and its postero-external process above being rounded. Its inner border articulates with both the frontal and nasal, here indistinguishably merged together.

An ethmoidal wing is not very powerfully developed and does not meet the lacrymal, as it does so extensively in the Fulmars and Petrels.

All the walls of the upper half of the orbit conspire to render it a hemiglobular cavity, the bottom of which is pierced by a considerable foramen leading to the opposite orbit.

The tract of the olfactory nerve is nearly, quite in some specimens, bridged over by the extension of the concave anterior wall of the brain-case. The optic foramen is small, circular, and usually distinct.

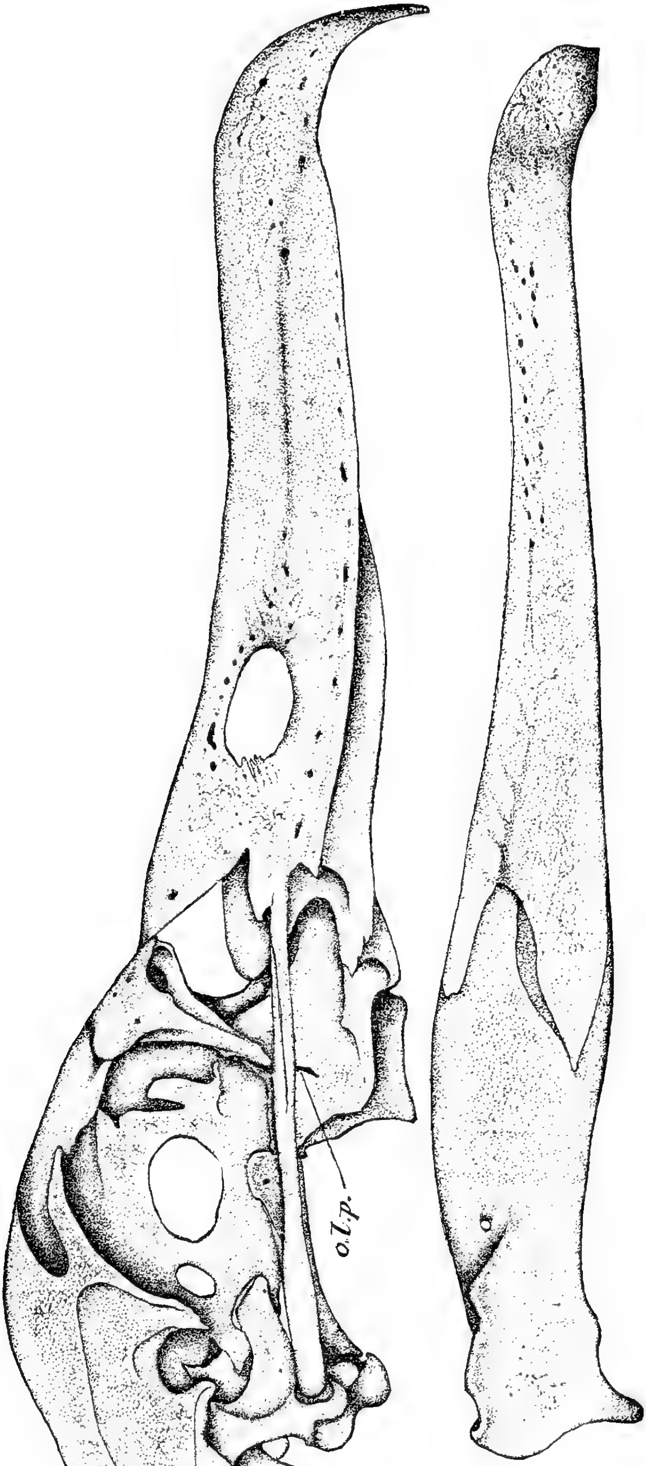


FIG. 13. Right lateral view of the skull of *Diomedea albatrus.* Drawn by the author from the same specimen shown in Fig. 12. Amount of reduction the same. The letters *o. l. p.* show the position of the "*ossiculum lacrymo-palatinum*" *in situ* from this aspect.

March 26, 1889.

Profundity of the orbit is much enhanced by the enormous post-frontal wings in this Albatross, and these are formed precisely in the same way as we found them to be in the Puffins, only here the base of the latter half of the nasal pit remains.

The crotaphyte fossa is nearly entirely lateral. It is broad, though feebly impressed, and separated as usual from the nasal glandular depression on the posterior aspect of the sphenotic process by a narrow isthmus of the general superficies of the cranial vault.

Each quadrate is a large, powerful bone, built upon the same plan, in so far as its facets are concerned, as we saw in the Fulmar and Petrel. In this Short-tailed Albatross, however, it is completely pneumatic, and a large foramen opens upon its posterior aspect.

Extremely interesting are the osseous openings to the internal ear, and the deep pit to the inner side of the mastoidal head of the quadrate, which would well repay thorough comparison with similar formations in the skull of the *Sula*.

A triangular, bony wing protects the foramen ovale in front, and a pneumatic foramen may pierce the skull in its neighborhood.

Viewed from above, we are enabled to see the furrows leading forward from the external narial apertures, the broad convexity between these latter and the cranio-facial region, where we can still see the traces of the nasal processes of the premaxillary.

Laterally are the lacrymals, with their sutures plainly visible connecting them with the naso-frontal margins.

Posterior to these we have the most striking features of this aspect of the skull; these are the supraorbital glandular depressions.

I know of no bird where these are better marked than in this Albatross, they being profoundly excavated and of a definite reniform outline. Their convex surfaces are opposite each other, and separated by a fronto-median tract of some width. Each base is deficient in bone for a little less than its anterior half, while behind they bear the impress of the convolutions of the glands they lodge in life, and are perforated by a few small foramina.

To the rear of these pits the vault of the skull is broadly convex and presents at either side the upper views of the post-frontals and crotaphyte fossæ.

In the skull of an undetermined species of Albatross (No. 16738 of the List) I notice that quite a perfect septum narium exists; a platform of bone extending between the lower margins of the external openings of the nostrils forms its base, while the septum is reared in the median line and has a small perforation in its center.

This specimen has also a broad front to its mesethmoid, which terminates in a transverse line at the cranio-facial hinge. Just beyond this a thin, triangular plate of bone is applied. The base of the triangle is also in the line of the cranio-facial hinge, though separated from the mesethmoid. Anteriorly its apex is produced to merge into the septum

narium in the median plane. This arrangement is exactly what we found in some of the Auks, though, of course, modeled to accommodate itself to the differently proportioned parts, and the nasal septum is also absent in the latter.

The cranio-facial hinge, then, in the Albatross is a very free one, though not so much so as we find it in *Sula*.

A direct basal view (Fig. 14) of the skull of *Diomedea albatrus* presents us from before backward the following points for examination: (1) The anterior half of the superior mandible is canoe-shaped, the prominent hook taking the place of the prow. (2) The largely developed palatines are considerably below the maxillo jugal bars; anteriorly they are carried forward as prominent and parallel ridges within the dentary borders of the premaxillary to subside on the inner sides of the canoe-shaped portion beyond. (3) The postero-external angles of the palatines are rounded, the "external laminæ" being sharp, while the "internal laminæ" are thickened and rather conspicuous carinations. (4) Between these latter an oval interspace occurs, which is carried forward as a deep median cleft as far as, or rather farther than, the point where the anterior ridges of the palatines described above subside upon the sides of the premaxillary. (5) At about the middle point in this cleft a small oval plate of bone makes its appearance; this is the foot of the anterior end of the large decurved vomer of this Albatross. (6) A short distance posterior to this appear two slit-like marks, one on either side, their free ends being behind and close to the palatine bones; these are the inferior arcs of the maxillo-palatines. (7) The pterygoids are strong, straight bones, their lower aspects being rounded, their upper ones longitudinally sharp-crested; their heads and the palatine heads all meet to form upon their upper side a deep groove for the rostrum. (8) A considerable portion of this latter may be seen between this articulation and the basi-temporal region in the median line. (9) The Eustachian tubes are open, naked grooves. (10) The basi-temporal triangular area is quite as much contracted as we find it in *Sula* or *Pelecanus*. (11) The condyle is rather elevated and transversely elliptical. (12) The foramen magnum is large, broadly elliptical, with its major axis, like *Pelecanus* and *Sula*, in the median line. It is at the base of a notable convexity which occupies all the area posterior to the basi-temporal region and extending from side to side between the mastoidal prominence.

The periphery of the foramen magnum lies in a plane which makes an angle of 45 degrees with the plane of the basis cranii.

In addition to these principal characters, we must also notice that the inner facets on the mandibular feet of the quadrates are the lower, and are about in the same plane with the lower margins of the internal laminæ of the palatines.

Returning for the moment to these latter bones, we find that their "ascending processes" are lofty and handsomely curled about the an-

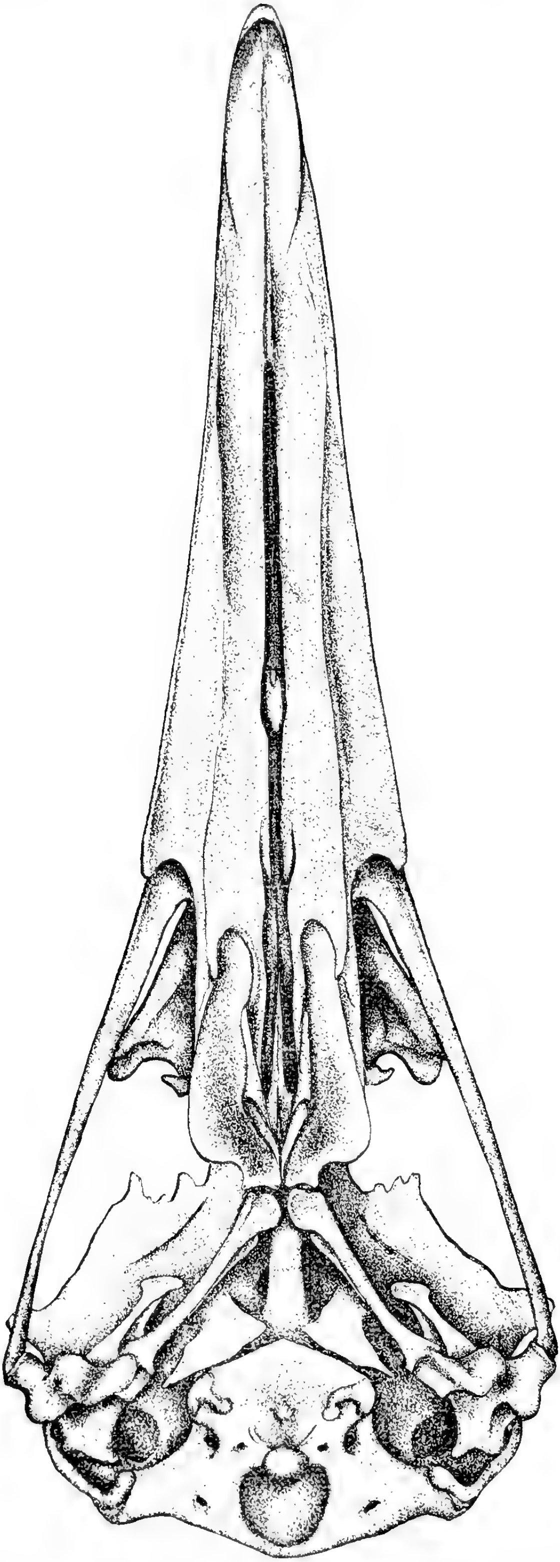


FIG. 14. Basal view of the skull of *Diomedea albatrus;* mandible removed. By the author from the same specimen as shown in Figs. 12 and 13; reduction the same.

terior portion of the united mesethmoid and rostrum. Their inner laminæ are produced forward to anchylose with the limbs of the *vomer*.

This latter bone is quite an extraordinary structure in an Albatross, and differs not a little in the various species. To get at its exact shape and relations to the surrounding structures I found that I was obliged to cut away certain portions of a spare skull and remove it, together with the pterygoids and mutilated parts of the palatines. From this specimen I made the drawings presented in Figs. 16 and 17.

Viewing this from above, we find that all three bones contribute certain of their parts to form a deeply excavated, longitudinal groove that extends the entire length of the structure. During life the spear-shaped rostrum rides in this, occupying, however, but the hinder two-thirds of the channel. Seen from the side, we find that the vomerine portion of this rostral bed is continued downward and forward as a median carination, which anteriorly curves down between the maxillo-palatines, to have its apex finished off in a little foot-like process which appears, as above described, in the interpalatine cleft.

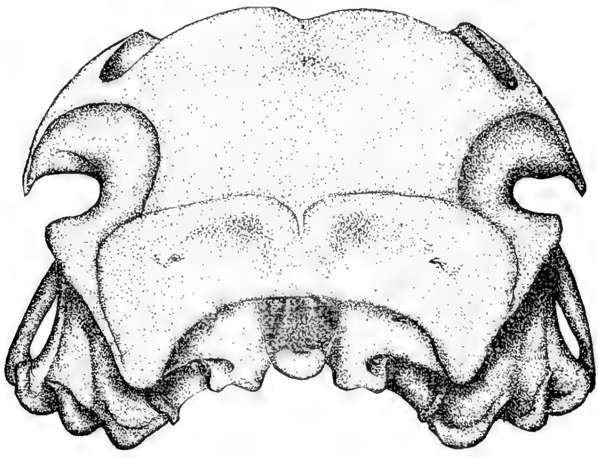


FIG. 15. Posterior view of the skull of *Diomedea brachyura*; mandible removed; life size. By the author from same specimen as Figs. 12 *et seq.*

In the undiagnosed skull of an Albatross (No. 16738) the pterygoids and palatines behave in the same way as in the Short-tailed variety, but the vomer shows no mid-channel beyond the end of the sphenoidal rostrum, is fully double the width of the other, and rather reminds us of the extraordinary vomer of Rodgers' Fulmar. Anteriorly, however, its tip is carried down to appear in the inter-palatine cleft, as in *D. albatrus*. Forbes figures a vomer similar to this for *D. exulans* in his *Challenger* memoir.

The *maxillo-palatines* are large, compact, elliptical plates. They stand but a few degrees removed from the vertical plane, each facing outward and slightly downward. Upon a lateral view the mandibular side nearly shuts this bone out of sight, and it is only in certain positions that we can secure a good look at it. The surface next the median

plane is smooth and but slightly convex, while the outer aspect has a rather spongy interlacement of bony trabeculæ thrown up against it, developed on the part of the maxillary, premaxillary, and nasal, which most effectively act as its main supports.

In two of my specimens I find a small, delicate rod of bone attached by ligament to the upper aspect of the palatine body immediately beneath the ethmoidal wing. These ligaments hold it in an upright position, and its superior and stouter end is bent toward the median plane; from this extremity, also, ligaments are attached which pass to the inferior border of the pars-plana and perhaps across to the descending process of the lacrymal. This little bone I take to be the os uncinatum of other anatomists, and said by them to occur both in the Albatrosses and Gulls. It seems to play no other part in the bird's economy other than to afford additional support to the membranous wall that forms the lower half of the partition between the orbital cavity and the rhinal chamber.

As I have elsewhere stated, I have found this bone in but few other birds than this Albatross, one of the specimens of which, *Diomedea albatrus*, has it in a very perfect condition on both sides.

It has been my misfortune, too, not to have seen Professor Reinhardt's paper upon this subject and his figures showing its position in other birds. Whether the *os uncinatum* is a constant ossification or not my material is not sufficiently extensive for me to say.

Professor Parker also states that he has discovered its presence in the Gull, but I have been unable to confirm this, although I have carefully examined many excellent specimens, with their ligaments still intact, of *Larus glaucus*, *L. philadelphia*, *Rissa*, and others. This is what makes me think that perhaps it may not be a constant ossification, or perhaps occurs only in old birds and not in immature specimens. Forbes says of this ossification that, "in connection with the descending limb of the lacrymal bone, there is often developed a peculiar ossicle, named by Brandt, who was the first to describe its existence, in *Diomedea brachyura* [*albatrus*] and *Puffinus major*, the 'ossiculum lachrymo-palatinum,' from its connection with those two bones.

"Its nature and relations in the group have subsequently been more extensively investigated by Reinhardt, who calls it the 'os crochu.'

"When best developed, as in the Albatrosses, the ossiculum lacrymopalatinum is a small styliform ossicle of nearly cylindrical (as in *Thalassiarche culminata* [Coll. Scientif. Mem., Pl. XXI, Fig. 7]) or somewhat lamellar (*Phœbetria fuliginosa* [Coll. Scientif. Mem., Pl. XXI, Fig. 8]) shape, attached above by an articulation to the inner face of the descending limb of the lachrymal bone, and below connected by a ligament to the upper surface of the palatine bone. Seen from the side, in the dried skull [his Pl. XXII, Fig. 1], the bone is visible below the malar arch. It lies, in the recent state, in a cavity between the nose and the roof of the mouth, in an oblique position, pointing downward and inward. This

bone is present in all the genera and species of Albatrosses examined by me, as well as in *Thalassiarche chlororhyncha*, as mentioned by Reinhardt. In the *Oceanitidæ*, in *Procellaria*, and *Cymochorea*, as well as *Daption* and *Pagodroma*, its place is taken by a narrow ligament, with a small, more or less ossified nodule of bone lying in it, only connected by connective tissue with the surrounding bones. In *Acipetes*, *Prion*, *Puffinus*, *Majaqueus*, *Adamastor*, and *Œstrelata* it is small and delicate, articulating with the lacrymal above and ending freely (in the cleaned skull) below.

"It is interesting to observe that a very similar bone, both as regards shape and position, occurs in the genus *Fregata*, as already pointed out by Reinhardt, whose observation I have been able to verify. But it also occurs in forms so different from these, as the *Musophagidæ*, many *Cuculidæ*, *Chunga*, and *Cariama*, as well as in some *Laridæ* and *Alcidæ*, so that its presence is obviously of no particular taxonomic value. Professor Parker informs me that its precise morphological significance is at present rather uncertain." (Coll. Scientif. Mem., p. 415.)

So prominent and jutting are the bony chambers which contain the organ of hearing upon the internal lateral aspects of the cranial cavity that the oval fossa, which harbors the hind brain in life, is far deeper than we would have any reason to suspect from an inspection of the posterior external view of the skull alone. This applies almost with equal truth to the fossæ lodging the other lobes.

The usual arterial and nervous foramina open here in nearly the same positions as we find them in birds generally.

Fig. 16.

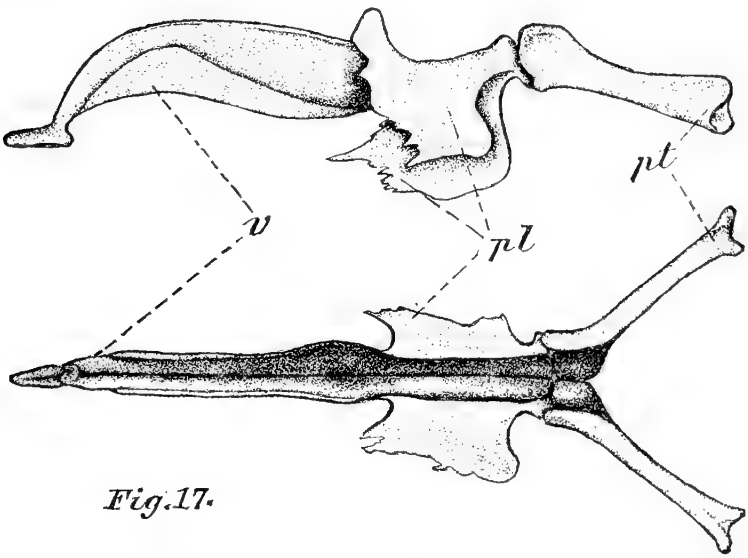


Fig. 17.

FIG. 16. Left lateral view of vomer, pterygoid, and part of palatine of *Diomedea albatrus*.

FIG. 17. The same bones viewed from above; *v*, vomer; *pl*, palatine (broken away in front); *pt*, pterygoid. Both figures life size. By the author, from another specimen presented him by Dr. T. H. Bean. The little foot on the anterior end of the vomer makes its appearance in the median cleft just beyond the maxillo-palatines, as seen in Fig. 14.

The pituitary fossa is deep and its posterior wall entire. There seems to be two carotid openings at its base, but they are very close together, and I would not be surprised to find them united in one in some specimens. The floor of this cranial cavity is a circular convexity, bounded on the sides by the bony wall of the middle ear, in front by the broad posterior wall of the pituitary fossa, while behind, after a low descent, it opens out upon the flat upper surface of the occipital condyle. In front of the pituitary pit we find a considerable of a partition separating the two distinct and circular optic foramina, each opening into an orbital cavity. Above these there is a nearly horizontal shelf, which supports the rhinencephalon, and at its anterior apex the hinder edge of the median ethmoid is visible, which guides each olfactory into its covered passage beyond. Considerable diplöic tissue is found between the tables of the vault of the cranium in this Albatross, and the skull as a whole seems to be pretty well permeated by air.

The sclerotals of an eyeball are comparatively small plates, with irregularly serrated margins. They differ somewhat in their general outline, and there seems to be no fixed plan as to the method in which they shall overlap each other.

The symphysial extremity of the *mandible* (Fig. 19) is formed very much as it is in the Petrel, and evidently constructed upon the same plan. Its symphysis proper is exceedingly short and the superior excavation deep.

Old Albatrosses have a median process co-ossified upon the under side of this with the bone. It is ensheathed in the horny integument of the bill, receiving a separate piece to cover it in that situation. The process itself is sometimes long and sharp, directed backward in the anterior ramal angle. It will be remembered that a somewhat similar structure was found in some of the Herons.

The shape of the mandible as a whole in this Albatross is precisely like the capital letter V, as in the Petrels.

Each ramus is deeper behind than it is in front, the transition being gradual, and lies principally in the vertical plane when the bird stands with his beak to the front.

The borders for nearly their entire length are rounded, the superior symphysial one alone being sharpened, and the coronoid process is but feebly pronounced. Both inner and outer aspect is for the most part smooth; the former for its anterior two-thirds is marked by a longitudinal, thickened ridge, while the latter shows many branching ramifications sunken below the general surface, and foramina, arranged in two rows, are carried to its anterior end.

The surangular is usually pierced by one or two small foramina in the same place as they appear in other water birds, where I have described them, though commonly only one is seen.

Albatrosses, in common with Auks, Gulls, Guillemots, and others, have a fan-shaped process developed by the surangular, which remains

more or less distinct throughout life. It is seen reaching forward on the inner aspect of the bone, and seems to be principally designed to hold the splenial element in place, which latter in *Diomedea* may or may not completely occlude the true ramal vacuity. Quite a fossa is sometimes found posterior to the blade of this fan-shaped process in birds where its handle is more or less individualized.

These mandibular elements, for flat bones, interlock and cross each other in the most remarkable way in the neighborhood of this foramen, and their study in all birds is a very interesting one.

The articular cups are very deep at their centers above, culminating in pneumatic pits; the usual circular foramen is also found near the end of the stumpy inner process of this part.

The facets and their arrangement are well shown in Fig. 18 and should be compared with others presented, as *Sula*, *Pelecanus*, and the Gulls.

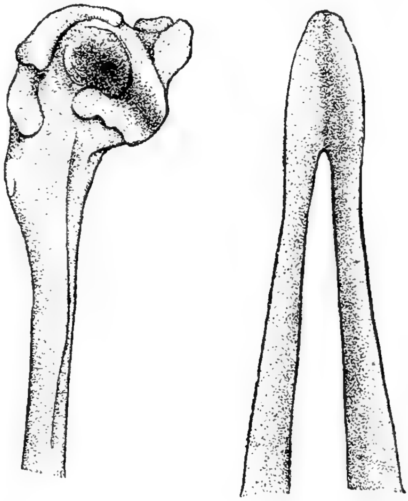


Fig. 18. *Fig. 19.*

FIG. 18. Articular extremity of right ramus of mandible of *Diomedea albatrus*; viewed from above.

FIG. 19. Anterior portion of mandible, from above; same specimen. Both life size. By the author, from the same specimen shown in Fig. 13.

Posteriorly the hind end of either mandibular limb presents a vertical face, and the angle is drawn down below in a somewhat tuberous, trihedral process.

Only about the proximal third of either ramus seems to be pneumatic; the rest of the bone is dense and solid.

Of the hyoid arches.—It will be seen from Fig. 20 that these do not very thoroughly develop in an Albatross. The glossohyal and ceratohyals never develop in bone, but are represented in cartilage even in very old birds (*D. albatrus*), and always remain so.

A strong antero-median process is developed on the inferior aspect of the first basibranchial, which offers upon its anterior face the articular facet for the cartilaginous glossohyal.

The body of this basibranchial is subcircular in outline, thick through and through, and co-ossifies with the median spine-like second basibranchial behind. This latter, like the epibranchial, is finished off by a cartilaginous tip.

Articular pits are found, one on either side of the first basibranchial for the heads of the long, slender, rod-like ceratobranchials. These articulate directly with the short epibranchials, and these are but slightly curved upward behind, as we find them in so many other birds.

Of the sternum and pectoral arch.—It would be impossible to convey any idea, by means of a drawing alone, of the extreme lightness of this

bone in an Albatross. Indeed, from the figures (21 and 22) I think one would be rather led to believe that this sternum was a thick and heavy one, so massive and ponderous appear all its anterior parts. But not only these, but all its walls, wherever they will admit of it, are absolutely honey-combed with pneumatic cavities. All that bulging promontory in front of the bone is in exactly the same condition.

The foramina leading to these cavities from without are very numerous, and occur in groups in several localities. Chief among these is a long, irregular, scattered row of them adown the entire median furrow of the visceral aspect of the sternal body. Collections of others are found up on the sides of the body on the same surface; some of these latter may even perforate the bone.

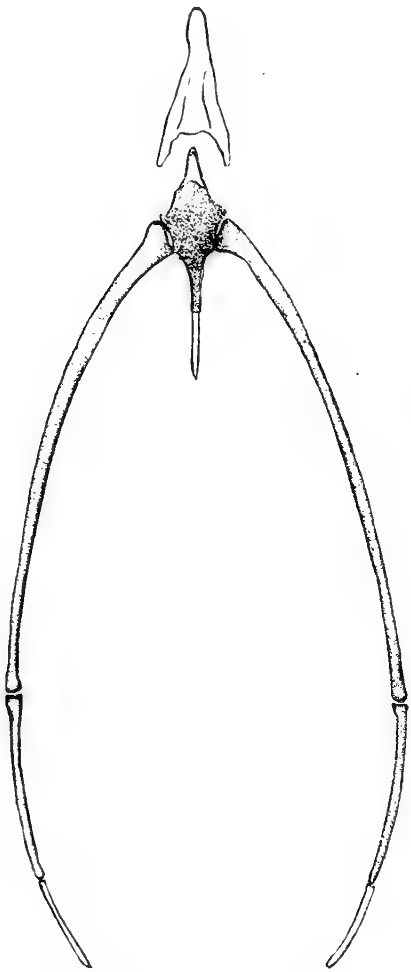


FIG. 20. Hyoid arches of *Diomedea albatrus*: viewed from above; life size. From the same specimen as Fig. 13.

The principal entrances to the sides, however, are through the collections of apertures found at the bases of the inter-articular fossæ upon the costal borders. Sometimes these are so large that we may obtain a view of the inside and plainly see the osseous trabeculæ thrown across in various directions to support the pectoral and visceral sternal walls.

Viewing this sternum from in front, we notice a deep and broad median notch, which is concave from side to side, and whose lateral walls on their outer aspects are devoted to the upper portions of the articular facets for the coracoids. This notch is shut out of sight from either a direct lateral view or a view from above. Lower down and at the sides we find the remainders of the coracoidal facets. These nearly meet behind the small manubrium; then slope downward and outward. They are concave in the vertical direction, but nearly straight the other way, and they connect with the others spoken of above at the upper sides of their inner ends.

Another facet is devoted to the coracoid upon the sternum of *Diomedea*. This is far removed from the first one, being concealed behind a lip of bone at the outer aspect and at the base of either costal process. This articular notch retains the end of the outer angle of the sternal end of the coracoid in place when the arch is articulated as in life.

These shielding lips of bone are well seen upon the pectoral view of the sternum shown in Fig. 20.

A lateral view (Fig. 21) shows the spreading costal process; the wide costal border below it, with the foramina between the hæmapophysial facets; the smooth and convex sternal body, and the thick and fairly well-developed carina.

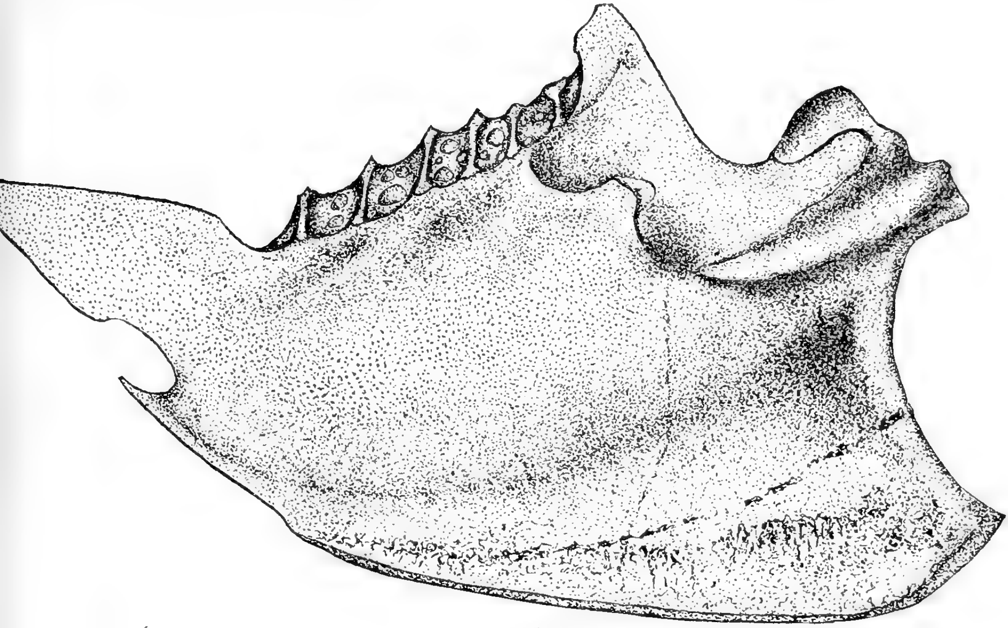


FIG. 21. Right lateral view of sternum of *Diomedea albatrus*; life size. By the author, from specimen 3333 of the Smithsonian collection.

The anterior border of this latter is concave forward, while its inferior one is nearly straight and stops short of the xiphoidal end of the body. The carinal angle juts out quite prominently and is thick through and through, the inferior border being produced and expanded upon it.

Regarding it from a pectoral aspect, we find the general outline of the bone to be nearly square, with its hinder margin exhibiting one deep notch, with the convex side forward and the postero lateral angles rounded. Analyzing this, however, we see that each postero-lateral portion is made up of one large subcordate process, due to the great median notch above alluded to, and shallow concave notches, which occur, one on either side, just behind the costal borders, and a median xiphoidal pair, one on either side of the produced middle part of the bone.

This sternum of the Albatross differs principally from the sternum in Rodgers' Fulmar in its being pneumatic, its method of articulation with the coracoids, and the form assumed by its xiphoidal border. *Puffinus* differs from both of them in having its xiphoidal border distinctly and profoundly two-notched, agreeing in this respect with most of the Jaegers and Gulls.

The *shoulder-girdle* (Fig. 23), due to the spreading furcula, is very wide from side to side, and, due to the short coracoids, is rather squatty in appearance. The furcula is one of the broadest among living birds,

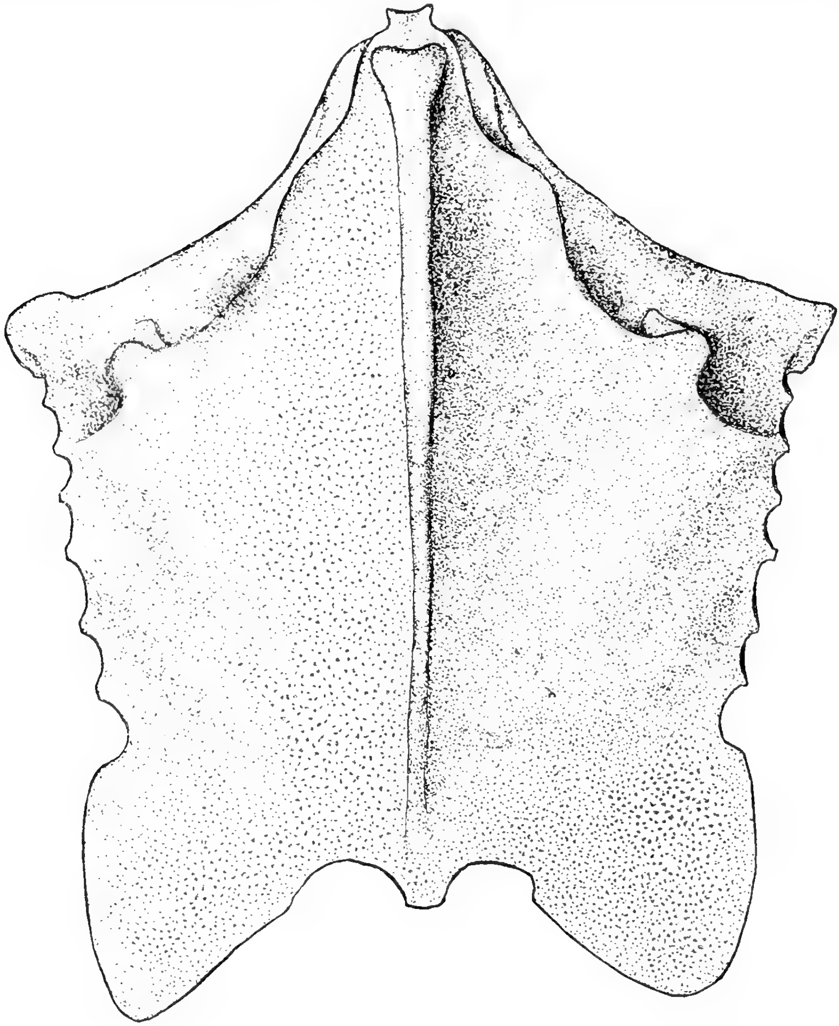


FIG. 22. Pectoral aspect of the sternum of *Diomedea albatrus;* life size. By the author, from specimen 3333, Smithsonian collection.

the shallowness of its U almost equaling that of the extinct *Hesperornis.* Each clavicular limb is, compared with the other elements of the arch, slender, and of nearly uniform caliber throughout. The heads gradually taper out to a point posteriorly, and articulate with the coracoids and scapulæ as they do in Rodgers' Fulmar, described above.

The middle of this arch below is thickened, being concave in front and somewhat produced behind, but bearing no proper hypocleidium, the modifications being apparently intended to give a greater surface for ligamentous attachment to the carinal angle of the sternum.

In some specimens, when the girdle is articulated *in situ*, this part of the furcula may rest against the apex of the angle of the carina, being thoroughly strapped to it during life by ligamentous bands.

It will be remembered, that anchylosis takes place at this point in

old Cormorants, and direct and extensive articulation in *Sula*, and, if my memory serves me right, something of the kind takes place in *Pelecanus* and *Tachypetes*.

The *coracoid*, though short, is extremely stout and massive in structure. The antero-posteriorly compressed shaft amounts to little more than a constriction between the head and wonderfully expanded sternal extremity.

The base of this latter possesses articular facets to correspond with those described on the sternum; the outer small one being connected with the large inner one by a gently concave and thin border.

Each externo-lateral angle of the base of a coracoid is produced as in the Fulmars and Petrels; it is here, however, a broad, quadrate process, instead of being carried out to a point, as in the latter birds. A coracoidal head is much flattened at its summit and smooth, while as a whole this tuberous extremity is directed forward and inward to develop a shallow facet upon its mesial aspect for the furcula to articulate with, as described above.

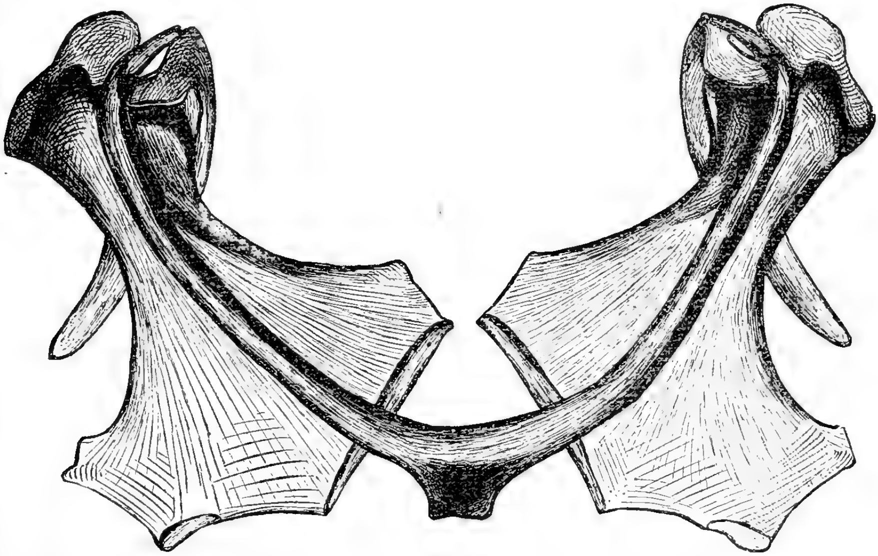


FIG. 23. The shoulder-girdle of *Diomedea albatrus;* anterior view; life size. By the author, from specimen 3333, Smithsonian collection. Collected by E. Herendeen at Cook's Inlet, Alaska.

Its scapular process is situate rather high upon the shaft, being concave from side to side in front, and rather flattened behind. Usually it is pierced by the foramen found in so many other of the water birds, and here quite close to the coracoidal shaft.

The glenoid cavity is comparatively small, so far as it is formed in bone, and no doubt in life its proper size is attained through the assistance of other structures. Coracoid and scapula offer each about the same proportional amount of surface to it as commonly seen among birds. A *scapula* is not much decurved along its blade, and this part of the bone is thickened, being nearly of an equal width throughout its length, though somewhat dilated at its hinder extremity, terminating in a rounded apex. Its head articulates with the entire width of

the scapular process of the coracoid on the transverse facet which occupies its superior margin.

The mesial angle of this head is tilted up to meet the posterior apex of the clavicle, when *in situ*, as naturally articulated. The furcula and scapulæ of this shoulder-girdle are both non-pneumatic, but the coracoids have air admitted to their internal cavities through a few foramina, which are situated on their posterior aspects in the broad concavity which is formed at each sternal extremity.

This condition of the coracoids in the Albatrosses disagrees with what we found in the Fulmars, these bones in *F. rodgersii* being completely non-pneumatic.

So far as the Tubinares are concerned, this completes the description of all the material I have at present at my command. Mr Forbes says that L'Herminier, A. Milne-Edwards, and Huxley have all, in describing various points in the osteology of the Tubinares, pointed out similarities of various kinds between their osseous structure and that of various forms of Steganopodes, though they still kept them close to the Laridæ. Eyton, on the other hand, places the various Petrels he describes in the family "Pelecanidæ," and Gulls forming a separate family by themselves.

"But no one will be prepared, I think, to dispute that the Steganopodes are allied to the Herodiones, including under that name the Storks and Herons, with *Scopus* only.

"Thus, on osteological grounds alone, there is sufficient ground for placing the Tubinares in the vicinity of the Steganopodes and Herodines. And, in fact, neglecting the desmognathous structure of the palate—the taxonomic value of which *per se* is becoming more and more dubious as our knowledge of the structure of birds increases—there is little in the characters assigned to the groups Pelargomorphæ and Dysporomorphæ by Professor Huxley that is not applicable to the general Petrel type."

It gives me a great deal of pleasure and satisfaction to quote these passages from Mr. Forbes's work (Coll. Scientif. Mem., p. 434), because of all the various schemes of classification and relationships proposed for the Tubinares that I have read none so well meet my own views in the premises as these.

OBSERVATIONS UPON SEVERAL OF THE AMERICAN REPRESENTATIVES OF THE ORDER STEGANOPODES.

This group is represented in the fauna of this country by six very well-distinguished families, viz:

1. The Phaëthontidæ,	The Tropic Birds.
2. The Sulidæ,	The Gannets.
3. The Anhingidæ,	The Darters.
4. The Phalacrocoracidæ,	The Cormorants.
5. The Pelecanidæ,	The Pelicans.
6. The Fregatidæ,	The Man-o'-War Birds.

At different times anatomists have devoted considerable attention to the structure of these birds, and every year, I think, we are becoming more unanimous upon the affinities they hold with other groups. On the present occasion I can contribute but little to this subject, although a good skeleton of *Sula bassana*—No. 16643 of the Smithsonian collection, and kindly loaned me by that institution—will permit me to illustrate the osteology of that representative of the *Sulidæ*. Then I will have something to add about the skeleton in the Cormorants and a word or two about the craniology of *Pelecanus*.

OSTEOLOGY OF SULA BASSANA.

Some of the smaller bones in my specimen are missing, such as the major portion of the hyoid arches, a few ribs, and joints of the toes, but in the main it is in excellent condition, and from it no doubt I can present a very fair review of the skeleton of this type.

Sula is noted for the high pneumatic condition enjoyed by almost its entire skeleton. We find this property extended throughout the axial portion of it, with the exception of the ribs and free caudal vertebræ. The pectoral limb is completely so, but in the pelvic extremity the femur is the only bone that appears to be pneumatic.

Of the skull.—In form the superior osseous mandible is flat upon its under side with cultrate tomium, while superiorly it is convex from side to side, and tapers from base to apex gradually to a point, being a little decurved near the extremity. Sometimes we find it pierced by a foramen on this upper side, which leads to its hollow interior, but *Sula* is without nostrils, though their probable position, did they exist, is perhaps indicated by the posterior end of the longitudinal furrow that marks the mandible upon its lateral aspect (Fig. 24).

An osseous, thoroughly adherent crust overlies the greater part of this superior surface, the only smooth place being a small area in front of the cranio-facial hinge. This envelope is very thin; nevertheless when compared with the smooth portion found above it its thickness is easily appreciated. Its entire surface is marked all over by an exquisite anastomosing venation, the ramifications starting, in some instances, from minute foramina in its substance.

A *lacrymal* is a free bone, articulating with a roughened facet of some extent beneath the antero-external angle of the frontal above, and by a smooth, gliding facet on the upper side of the maxillary, which latter bone is thickened in a perpendicular direction and otherwise enlarged in order to offer it the proper amount of surface. As for the bone itself, it is of rather a columnar form, with the exception of its extended anterior margin, which is roundly notched and shows on its inner side the large pneumatic opening leading to its hollow interior.

In Gannets there exists, projecting horizontally from the outer margin of the frontal bone, on either side, from its "prefrontal process," a few millimetres posterior to the fronto lacrymal suture, a small rounded

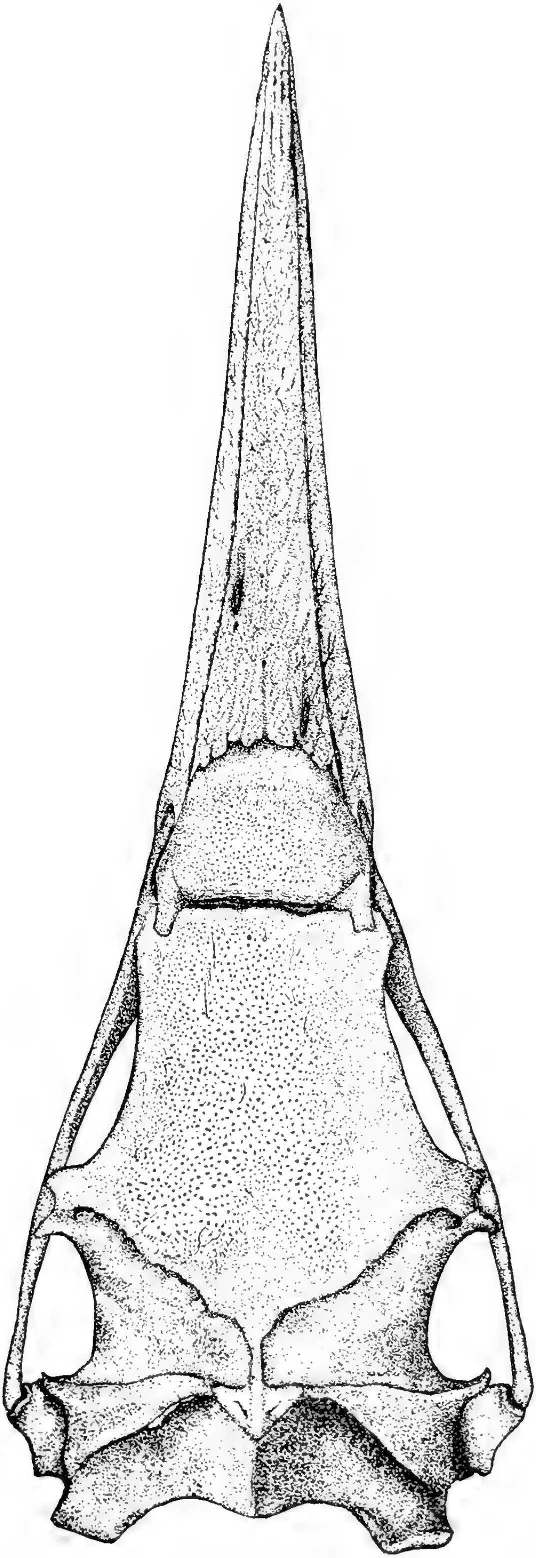


FIG. 24. Skull of *Sula bassana;* viewed from above; mandible removed; life size. By the author, from a specimen in the Smithsonian collection.

ledge of membrano-cartilage, which reminds one of the horizontal portion of the true lacrymal bone in certain gallinaceous birds, as the *Perdicinæ*, for example. This feature has been studied by me in *Sula brewsteri* and *S. gossi*, specimens of which I am indebted to Mr. E. J. Reed of Guaymas, Mexico, who kindly collected them for me. This membrano-cartilaginous process probably never ossifies in the *Sulidæ*.

In the adult bird it is impossible to distinguish the exact position, or any of the borders, of the nasal bone.

The maxillo jugal bar shows very plainly the suture between the jugal and quadrato-jugal; the latter is much smaller than the other portion, and shows a strong peg-like process upon the inner aspect of its posterior end, which is at right angles to the axis of the bone. It fits in the deep conical socket on the side of the quadrate. Beyond its enlargement for the lacrymal the maxillary is a thin, horizontal plate of bone, anchylosed in the usual way at its anterior end. Here it really enters into the apparatus of the cranio-facial hinge. A process pointing backward and apparently coming from the premaxillary is seen over this horizontal plate of the maxillary on either side. Professor Parker found this condition present also in another species of *Sula*, and this eminent anatomist also describes a "post-maxillary" for these birds which heightens the zygoma, overlying, as it does, its commencement.

In this specimen the interorbital septum, which is a thin, smooth plate, shows considerable of a fenestra near its middle, and a few such openings of a very much smaller size pierce its posterior wall.

The circular optic foramen is entire, is of a size apparently three or four times the caliber of the nerve it passes, and it seems to include the smaller foramen to its outer side.

The orbital cavity itself in this Gannet is very deep, the eaves of its roof almost overhanging the jugal bar beneath. Its superior periphery is smooth and rounded. All in front of the rhinal chamber is filled in by the spongy mass formed by the united maxillo-palatines. The hinder portions of these bones are, however, still distinct, and they have all the appearance of these elements as they are found in birds which possess them as concavo-convex plates facing outward.

The rostrum of the sphenoid is a hollow subcylindrical tube, united above with the interorbital septum. As we proceed anteriorly it becomes more flattened from side to side, and gradually rises upward. At a point about half way between the palatines and cranio-facial hinge it terminates in a process directed forward; above this is the sharpened ethmoidal margin, nearly perpendicular to the long axis of the skull. Osseous wings to the ethmoid never develop in *Sula*, not even rudimentary traces of them being seen at their customary sites.

The cranio-facial hinge is exceedingly perfect in its construction, being composed of a thin plate of bone occupying the full width of the skull; the bones both above and below are separated from each other by a small interval for the entire length of the transverse line constituting the hinge.

The part played in the mechanism by the maxillaries has already been described above.

We find the sphenotic process to be bifid and jutting directly out from the side of the skull; on the other hand, the mastoidal process is a crest of bone curling forward. Between these two the very wide crotaphyte valley is seen.

The quadrate is a large, massive bone, with its mastoidal head composed of two prominent ellipsoidal trochleæ, separated from each other by an intervening notch. Below these the shaft is seen to be rather compressed in an antero-posterior direction, and supports in front at its lower half an unusually formed orbital process. This is a thin, triangular plate of bone placed in the vertical plane, and with its apex directed forward. The pneumatic foramen of the quadrate usually occurs on the posterior aspect of the shaft in most birds, but here it is situated to the inner and lower side of this orbital process.

The pit for the quadrato-jugal is cylindrical and deep, and a perforation at its bottom may lead into the hollow of the bone. On the posterior aspect of the quadrate we find an irregular facet for the mandible; it looks directly to the rear and stands at the head of a longitudinal and deep groove which is found between two similarly placed facets on the foot of the bone.

Each pterygoid is a trihedral and compressed bone with prominent borders.

Regarding this skull from a superior view (Fig. 24), we see in it a foramen in the superior mandible near the site of the narial opening of the majority of other birds. From this aspect we also have a good view of the wonderfully perfect cranio-facial hinge of the Gannet.

Posterior to this is a broad, smooth area, very slightly convex, and showing only at its hinder half the barest trace of a longitudinal furrow. This surface extends from the cranio-facial hinge to the anterior border of the crotaphyte fossæ, while laterally it is bounded by the margins of the orbits.

This view also shows the extent and form of these crotaphyte fossæ and how they are separated from each other in the median line simply by an extension backward of a very narrow strip of the general surface that lies beyond them. They are bounded behind by conspicuous and sharpened crests that curl slightly forward, and are best marked laterally, becoming very low as they near the upper part of the supra-occipital prominence.

The under view of the skull reveals a number of interesting points. We find that the anterior portions of the palatines are parallel to each other, separated by a median cleft of a width equal to either one of them, and which becomes pointed behind.

Their anterior ends do not merge into the premaxillary beyond until they are well past the points where the maxillaries are inserted. These anterior portions are thin, horizontal plates, being directly continuous

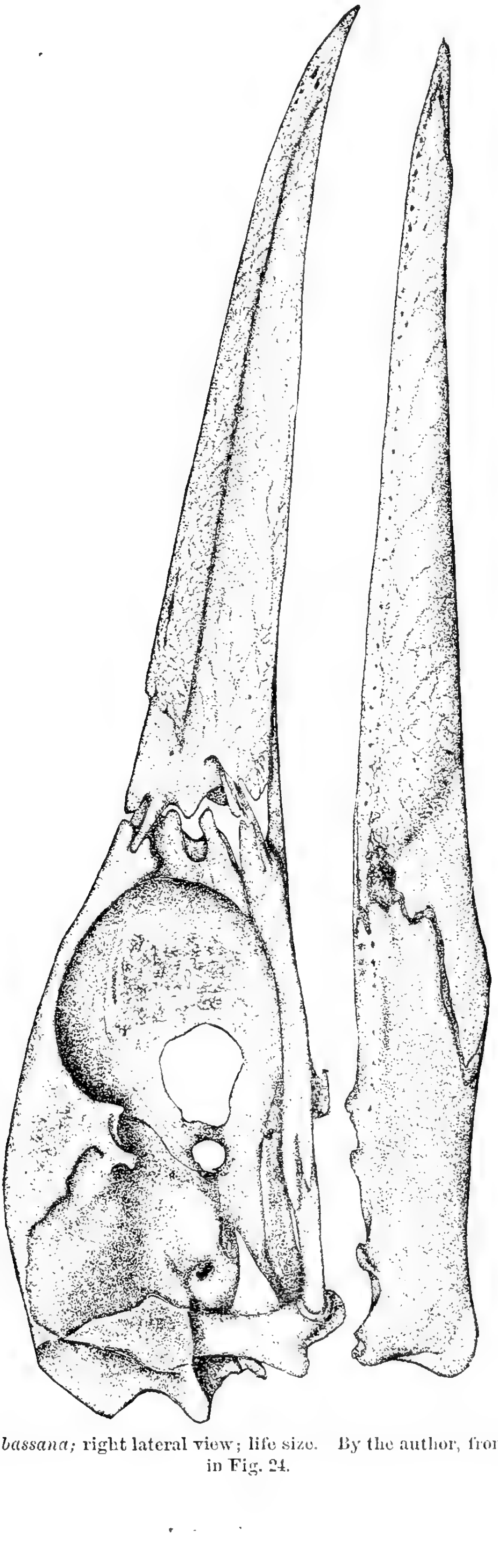


FIG. 25. Skull of *Sula bassana;* right lateral view; life size. By the author, from the specimen shown in Fig. 24.

with the horizontal and fused palatine bodies behind. This latter portion shows a small median carination just in front of the united heads, and the postero external angles are rather sharp, being pointed directly backward.

Anteriorly, the pterygoidal heads meet each other and the fused palatines, the three forming a groove on their upper sides for the rostrum. At their outer ends each pterygoid offers a shallow cup to form the usual articulation with the quadrate of the corresponding side.

Professor Parker found that "in *Sula alba* the basi-temporals are as little developed as in the *Dromæidæ*, less than in any other carinate bird. Behind each moiety there is a large oval opening, not far in front of the occipital condyle; this exposes the loose diploë within. The small Eustachian tubes open at a little distance from each other, in a wide, shallow fossa, on the part where the three elements of the parasphenoid meet." The description of these details agrees with the skull of the specimen before us. Professor Parker, however, was fortunate in having the skeleton of the ear parts in his specimen, and of them he says that "in *Sula alba* the columella auris is very long and bent. It has a small, cartilaginous, extra supra-stapedial process and a long attenuated stylohyal."

On either side, the entrance to the middle ear in this Gannet, as in others of the same genus, is shallow, and it is situated quite internal to the quadrate bone, while immediately mesiad to it there is a pit of great depth, with its aperture looking downwards, and its base in the vault of the cranium, which seems designed for muscular lodgement; the positions of the usual foramina about it are peculiar, and extremely interesting in these birds.

The bony wings that shield the entrance to the ears are large and tilted up behind. Each one shows the double facet for the mastoidal head of quadrate, the outer one having its inner margin encroached upon by the pit described above.

The postero-internal angle of either of these wings is connected with the side of the elevated basi-temporal region by a bony bar. This condition can best be seen from a posterior view. When speaking of the orbital cavity I neglected to mention that the upper part of the septum is longitudinally marked, as in most birds, by an open, single groove for the passage of the olfactory nerve to the rhinal space beyond. The exit for it from the brain-case is very small, indeed, and on one side the bone spreads over it, rendering the nerve track, for a fraction of the initial part of its course, tubular.

The brain-box itself is capacious and notable for its great width over its compression in the vertical direction. Its anterior wall looks directly downward and forward, making an angle of about 45 degrees with the horizontal palatine bodies. Seen from behind (Fig. 27), the skull shows above the extent to which the crotaphyte fossæ approach each other in the median line and the crest that divides them from the occipital area.

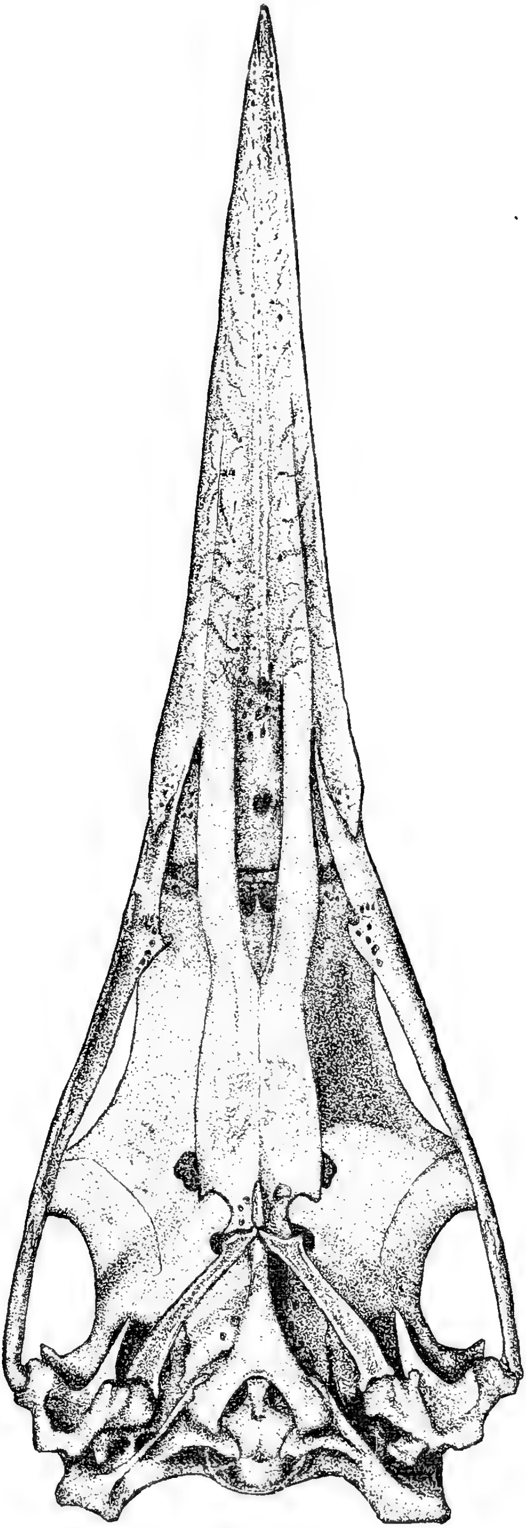


FIG. 26. Skull of *Sula bassana;* basal view; mandible removed; life size. By the author, from the saem specimen shown in Figs. 24 and 25.

This latter has the usual form seen among these cormorant like birds, constituting an arch over the foramen magnum, which occupies the center of a concavity below it. The supra-occipital prominence is here distinguished by a low, smooth, median ridge, which traverses this dome-like elevation from the intercrotaphyte line to the superior periphery of the foramen magnum.

The plane of this latter aperture is about perpendicular to the plane of the basis cranii. In outline the foramen is broadly elliptical, with the short axis transverse. At its lower margin we see a large ellip-

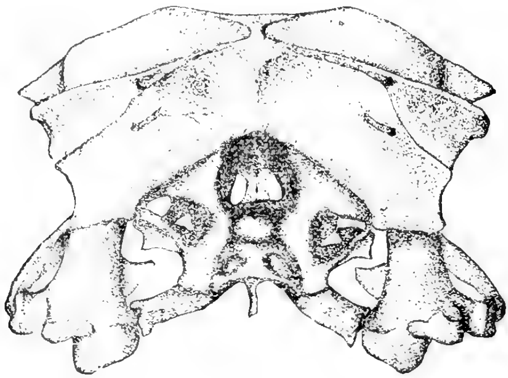


FIG. 27. Posterior view of the skull of *Sula bassana*: mandible removed; life size. By the author, from the same specimen shown in Figs. 24 *et seq.*

soidal condyle, with its short axis at right angles with that of the foramen. Below this again are the oval openings in the basi-temporal, spoken of by Parker, with the prominent descending processes of this region flanking them on either side.

In form the inferior *mandible* is spear-shaped, its sides tapering gradually to a sharpened apex. These latter, for the outer aspects of their anterior two thirds, show the same character of venated surface as I described for the superior mandible. Posterior to this, however, as well as the inner ramal aspects, the bone is smooth, having the same appearance as in most birds.

The symphysis is short and develops a spine behind, which points directly backward and is in every respect similar to the process in the same place, between the sides of the lower jaw, in Herons and Albatrosses. Each ramus of this mandible is very thick from side to side, but these parts are hollow, and the bone as a whole is very light, owing to the high state of pneumaticity it enjoys.

The foramina for the entrance of air to its interior are four in number, two on either limb, one being to the mesial side of the articular cup, and another larger, longitudinally placed, elliptical one just beyond this concavity on the inner aspect of the ramus near its upper border. The superior side of an articular end has a deep excavation at its center upon which the facets for the quadrate do not encroach, so that, when the jaw is articulated, this pit comes opposite the notch be-

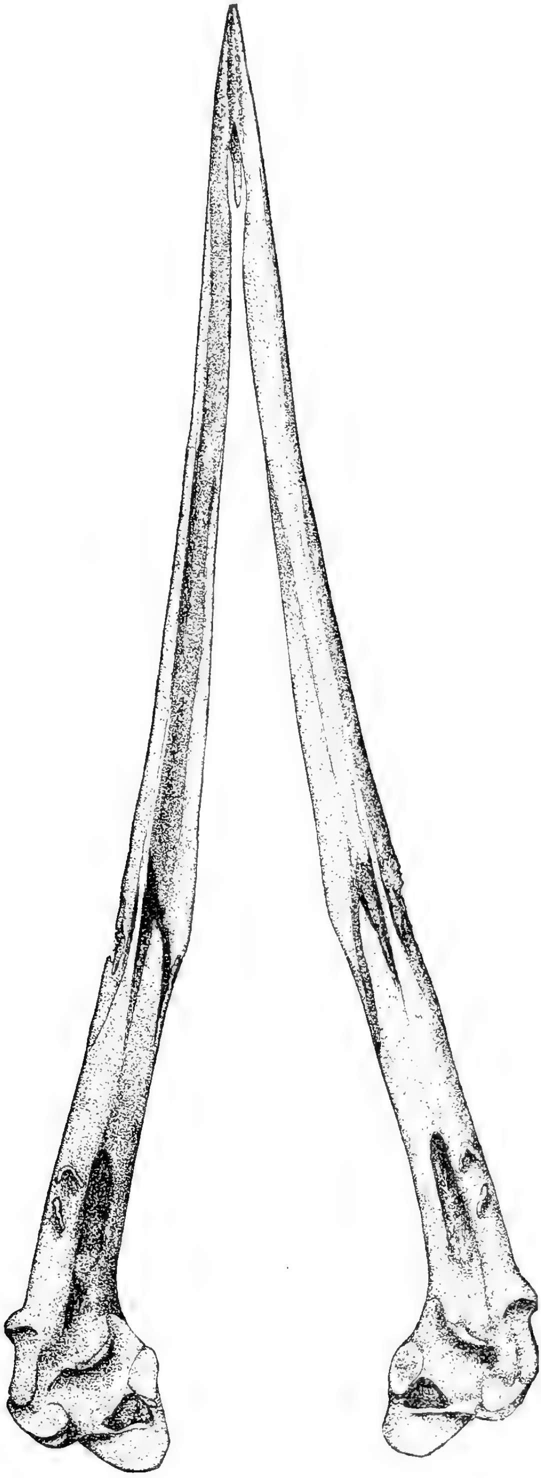


FIG. 23. Inferior mandible of *Sula bassana;* seen from above; life size. By the author, from the same specimen figured in 24 *et seq.*

tween the trochleæ of the mandibular foot of the quadrate, creating an irregular hollow space there of no inconsiderable size between the bones. When the quadrate thus covers it there are two entrances that are left open, one in front and one behind, close to the pneumatic foramen.

The mandibular angles are truncate and very nearly perpendicularly so, their surfaces being concave and very broadly luniform in outline.

Commencing just in front of an articular cup, we find the superior border of the ramus to be rather wide and rounded as far as the meeting with the dentary. This portion presents near its middle a double coranoid process, one being in front of the other. The dentary portion of this border has an outer cultrate edge and an inner and somewhat lower rounded one.

The outer edge goes to the anterior apex of the symphysis, the inner one to the hinder termination of the same, while between the two a nearly horizontal surface is contained, which gradually becomes narrower as we proceed in the forward direction.

The lower borders of the mandible are rounded for their entire extent, being produced beneath the articular cups and continuous with the inner boundary of either truncate angular extremity.

We find that the usual bones which surround the true ramal vacuity on the side of the mandible in many birds here interlock with each other so as to completely fill the fenestra in, but in rather an unusual way and apparently for a definite purpose; for each ramus presents, both on its inner and outer side, an oblique slit, these slits being opposite each other and with their anterior ends in the superior border. It is evident that this otherwise thick jaw is much weakened at these points in each ramus, and this occurs just posterior to the hinder termination of the horny sheath of the lower beak. In other words, the hinder moities of the mandible are attached to the anterior or dentary portion by thin plates of bone, consisting principally of the splenial elements, and are capable of being bent outward, which in the recent specimen can, owing to the way the quadrates are attached, be effected to a considerable degree. Now in life these oblique slits have their anterior ends come opposite the thin anterior insertions of the maxillaries, and these latter are just beneath the very mobile cranio-facial hinge, so that the whole apparatus is admirably arranged to permit an increase in size of the fore part of the buccal cavity when this Gannet swallows the fish that constitutes its food, and which its beak is so well fitted otherwise to capture. Moreover, this possible increase in caliber takes place in that portion of the digestive tract where it is most needed, or where the bony walls of the mouth would prevent the admission of a very large morsel unless some such mechanism existed—at the very entrance of the buccal cavity and just posterior to the more horny thecæ of the beak. In Gannets, however, this mobility is to an extent restricted by the integumental sheath of the beak.

OF THE REMAINDER OF THE SKELETON OF THE TRUNK IN SULA BASSANA.

In this specimen of the common Gannet there are twenty-one free vertebræ in the spinal column before we meet the one that first anchyloses to form, with the assistance of the thirteen succeeding ones, a sacrum for the pelvic bones. Then follow eight more free ones devoted to the movable part of the tail. Finally, we have a long pygostyle that probably contains at least six more.

They are all completely pneumatic save those ulterior free segments in the tail and the pygostyle. The sixteenth and seventeenth vertebræ support each a pair of free ribs; the next four belong to the dorsal series, and all have true vertebral ribs articulating with costal ribs from the sternum. This is also the case with the first two pair that spring from the pelvic sacrum. Behind these there is still another pair of ribs that very much resemble the post-pubic elements in form, whose hæmapophyses do not reach the costal borders of the sternum.

In mid-series these ribs support movable epipleural appendages, attached in the usual way to their posterior borders. As I have already stated above, they are completely non-pneumatic.

The neural canal is notable for being nearly cylindrical throughout the first twenty-one vertebræ; it is only at the region of the enlargement for the brachial plexus that it is rather compressed in the vertical direction.

The atlas has a minute perforation in its cup, and its neural arch is strikingly broad and deep. Axis vertebra possesses a stumpy neural spine, and its hypapophysis, directed somewhat backward, is very prominent.

The odontoid peg is comparatively small and nearly sessile with the centrum, the latter presenting a concave face below it.

From the third to the fourteenth vertebra, inclusive, the neural spine is a very inconspicuous character, while from this on it gradually makes its appearance, increasing in size until we have the usually quadrate, longitudinal plate of the dorsal series.

Third and fourth vertebræ have each a prominent hypapophysis like the one in the axis, but in the fifth this feature nearly entirely disappears.

Sixth vertebra is faintly marked by the carotid canal; this gradually becomes more and more tubular in the seventh, eighth, and ninth, while in the tenth to the thirteenth, inclusive, it is a closed cylindrical canal of a caliber somewhat less than the neural canal above it. It disappears entirely from the fourteenth vertebra.

The lateral canals extend from the third vertebra to the fifteenth, inclusive; they are short in any of the segments, and their posterior apertures are far larger than their anterior ones.

At the commencement of the cervical series the parial parapophyses are short and not particularly well developed. They project backward

from the inferior walls of the lateral canals, but as the carotid canal begins to develop these processes withdraw from the former positions, move gradually lower down beneath the centrum, at the same time increase in length and importance, so that in those vertebræ where the carotid canal exists they project from its postero-inferior border directly backward as parallel and not far-separated spines.

The post-zygapophyses do not appear as divergent limbs until we find them so in the eighth vertebra; in all the cervical segments anterior to this one the facets are situate on the inferior aspect of the tuberous hinder end of the neural arch at its lateral angles.

Metapophyses are seen on the ninth vertebra, but gradually disappear, to be entirely absent in the fourteenth or fifteenth.

The transverse processes in the dorsal region are broad, flat, and horizontal, being directed more and more to the rear as we approach the pelvis. The plates of the neural spines above do not meet each other when the column is articulated, and there is an entire absence of all interlacing, ossified tendons or metapophyses in this region. In fact, all the vertebræ have a very clean-cut, non-angular appearance, with the majority of projecting borders rounded.

The articular ends of the centra are constructed upon the "heterocœlous" type; the anterior faces in the ultimate cervicals and leading dorsals being notably wide and shallow, and often riddled with foramina.

Pygostyle and the free caudal vertebræ will be spoken of after the pelvis has been described; in the mean time we will turn our attention for a few moments to the description of the sternum and pectoral arch.

The sternum (Figs. 29 and 30).—This bone in a Gannet has the most unique form possible. A pectoral aspect of the bone shows that the body has an oblong figure or outline, with the average width nearly equal to half the length. Beyond this parallelogramic part the anterior portion projects as a massive-promontory, and a large part of the carina is beyond this again.

The anterior moiety of the bone is convex on this side, and correspondingly concave on the thoracic aspect. Behind, the body is so flattened out as to be nearly horizontal. The costal borders look outward and slightly upward, and each possesses six moderately well-developed facets for the costal ribs. There are no pneumatic foramina in the elongated and shallow intervals.

The principal orifices of this character consist in a diffuse group on the superior aspect of the anterior projecting part, within the general concavity of the bone.

Either costal process gracefully rises from its base as a laminated and prominent horn, curving in the anterior direction.

The posterior moieties of the lateral borders are somewhat rounded and extend almost directly backward over the lateral processes behind.

These postero-external xiphoidal processes are very long and wide, being rounded off at their extremities and directed a little outward.

They are created by this hinder portion of the bone being so profoundly one-notched that a general concave margin has resulted, with simply a median papilliform process remaining (Fig. 29).

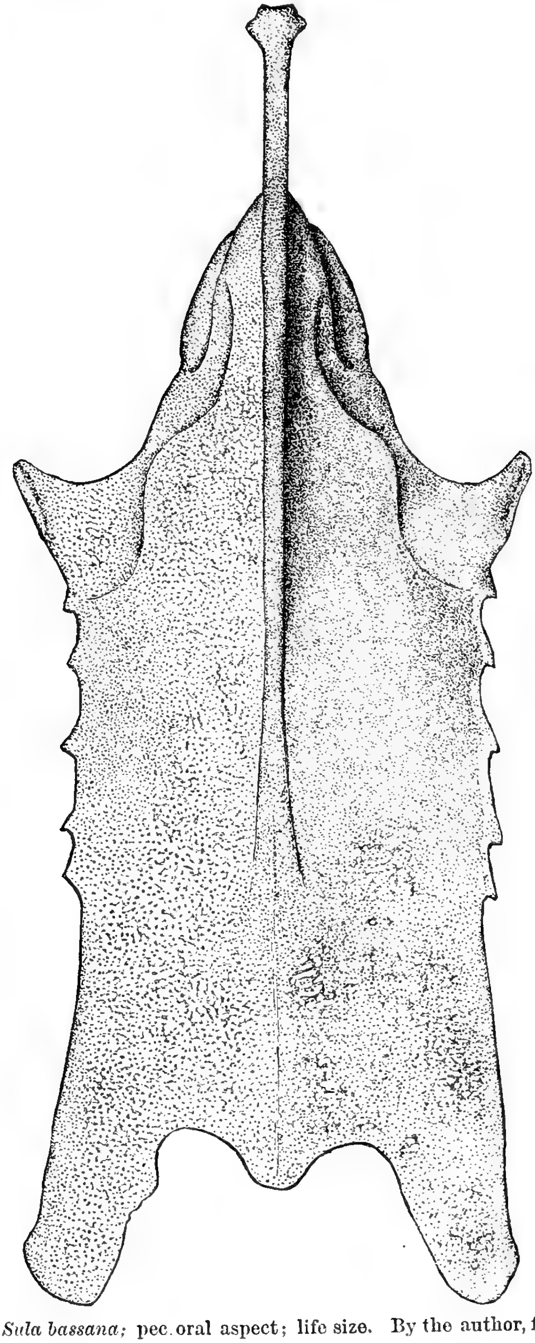


FIG. 29. Sternum of *Sula bassana;* pec. oral aspect; life size. By the author, from the same specimen shown in Figs. 24 *et seq.*

The carina juts out very prominently in front of the bone; its anterior angle showing a large facet, concave from above downward, for the furcula, which in life articulates with it. Above this the border is again

concave and sharp, while above this, again, there is a compressed process that represents the manubrium.

The lower border of the keel is straight and in the horizontal plane, being capped off with a spreading rim. This border merges into the surface of the body of the bone before it half way reaches the xiphoidal notch.

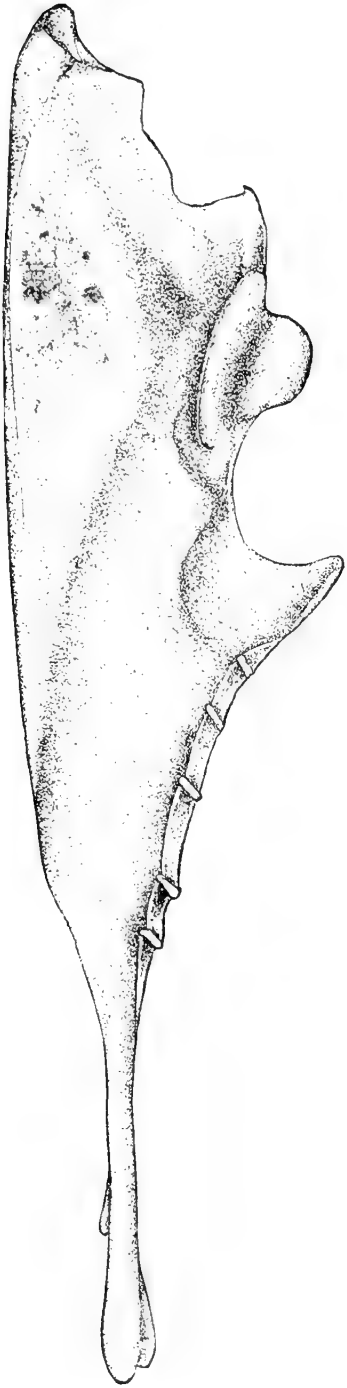


FIG. 30. Sternum of *Sula bassana*: left lateral view; life size. By the author, from the same specimen as shown in Figs. 24 *et seq.*

The sides of the keel are smooth, and neither it nor the under side of the sternal body show, in this specimen, any of the muscular lines usually present in most birds.

A broad median notch, concave from side to side, convex from before backward, lies between the lofty superior portions of the coracoidal grooves. These latter meet in front of it at the manubrial base, while behind its surface becomes directly continuous with the general surface of the upper side of the body, and right where the group of pneumatic foramina are found.

A coracoidal groove looks forward and outward for its upper portion, directly upward for its lower, and extends about half way between the base of the costal process and the manubrium. It consists of two portions which are directly continuous with each other. The lower one is a shelf-like projection, with a convex border forward and its articular surface in the horizontal plane. Immediately above this rises a much broader surface, though not so long, which is decidedly convex from above downward. This portion of the facet for the coracoid is considerably higher than the plane in which the borders of the body of the bone are found. It faces forward and outward, and has one regular convexity as its limiting margin above.

Between the point of its outer termination and the apex of the corresponding costal process the border is one sweeping concavity.

This form of sternum seems to be peculiar to the *Sulidæ*, and it differs in a number of points both from the Cormorants and from the Pelicans. Nor do we see any-

thing in it to remind us of birds of more distant kinship, as the Albatrosses. In other respects, however, it presents characters common to all of these, and not a few resemblances with the last-named group. When this sternum is articulated with the shoulder-girdle its fantastic shape is by no means diminished, for the forms of the various bones which compose the latter, and now to be described, are equally curious and decided departures from the more common style of these elements.

Of the shoulder-girdle (Figs. 33, 34, and 35).—This part of the skeleton is, like so much of the rest of it, thoroughly pneumatic, the foramina occurring at their usual sites.

The clavicles form a broad U-shaped arch, and are completely united below, where, at their under side at the median point, they support an extensive facet for articulation with the carinal angle of the sternum. This does away with any such a thing as a hypocleidium proper, still the bone projects slightly over this facet.

The clavicular limbs are compressed from side to side, broader above than below, with the anterior and posterior borders rounded off.

A clavicular head is also compressed in the same manner as its shaft, and tapers off as a pointed process.

The most striking feature about this part of the bone is, however, the extraordinary facet it supports to articulate with the coracoid.

Either one of these is situate at the outer aspect of a head, upon a promontory of bone there found of a proper form to receive it. The facet is of an elliptical outline, placed vertically, and facing directly backward. Something of a notch is found between it and the clavicular head, in which occurs a number of the principal pneumatic foramina of the furcula. On the anterior surface, just below the summit of a *coracoid*, we find a distinct elliptical facet for articulation with a similar one just described for the fourchette. Between this and the ear-shaped glenoid facet considerable of a valley is found. On the opposite side of the coracoidal head we find a group of pneumatic foramina and below these a peculiarly formed scapular process, a spine-like apophysis, which rather gracefully curls upward and then toward the shaft of the bone.

This latter portion of the bone is subcylindrical and smooth, dilating below into a transverse fan-shaped sternal extremity.

A *scapula* offers but a very small portion of the articular surface for the glenoid cavity; not more than an eighth of it in the present specimen.

The head of the bone then reaches forward and inward, but only the outer two-thirds of this makes an indifferent articulation with the narrow and roughened border of the scapular process of the coracoid.

The shaft of the bone is quite stout behind this and somewhat compressed in the vertical direction, while posteriorly it flattens out into a broad paddle-shaped extremity that finally tapers to a point behind, (Fig. 35.)

Of the pelvis and caudal vertebræ.—The first vertebra that anchyloses with the pelvic sacrum projects entirely beyond the iliac bones (Figs. 31 and 32). Its centrum, in common with the next three that follow it, is much compressed from side to side, and its neural spine is continuous with the common neural ridge above of the succeeding segments.

The first five vertebræ that lie beneath the ilia throw out their apophyses in the usual way for their support; the last two of this series meet the iliac margins. Here the neural canal and centra are large, so as to afford room for the increase in size of the cord where the sacral plexus is thrown off.

Twenty-eighth and twenty-ninth vertebræ have their processes thrown directly upward, so that they are not visible upon direct ventral aspect.

In the thirtieth vertebra they are powerfully developed and extend directly across the basin to abut by anchylosis against the pelvic walls immediately behind the cotyloid cavity on either side. From this point the centra of the uro sacral segments taper quite rapidly in size to an enlarged facet on the posterior aspect of the last one, intended for the first free caudal.

The extremities of their diapophyses anchylos in a very thorough manner with the inner iliac margins, and a lateral view shows their sides to be riddled with pneumatic foramina between these processes.

Viewing this pelvis from above, we notice that the entire inner margins of the iliac bones have merged into and completely anchylosed with the sacrum.

This converts the ilio-neural grooves into ilio-neural canals and gives the bone a very compact appearance.

The anterior margins of the ilia are rounded and are set off with rather a deep and raised emargination.

Post- and pre-acetabular surfaces are about equal in the extent of their superficial areas.

The anterior iliac surfaces are concave on either side, and each faces upward and outward to about an equal degree.

Elevated above these anterior iliac concavities we find the post-acetabular area to be nearly horizontal. Large elliptical foramina are found between the apophyses of the last three or four uro-sacrals, and these latter, likewise, develop quite a prominent neural crest.

Upon lateral aspect of this pelvis we find a very large cotyloid ring, the inner margin of which is fully equal in size to the outer. A moderately sized antitrochanter occupies its usual site, with its articular surface directed downward, forward, and outward.

Behind this occurs an enormous elliptical ischiac foramen, that occupies nearly all of this post-acetabular lateral aspect. Through the fenestra thus formed we are enabled to get a good lateral view of the uro-sacral vertebræ and the extensive pneumatic condition they enjoy (Fig. 31).

The lower margin of the ilium is sharp and convex; it forms the su-

perior boundary to a long, narrow, obturator space, which opens freely into the rather small obturator foramen.

A pro-pubis does not develop in this Gannet, while the post-pubis is for the most of its extent fragile and slender. It begins to increase in

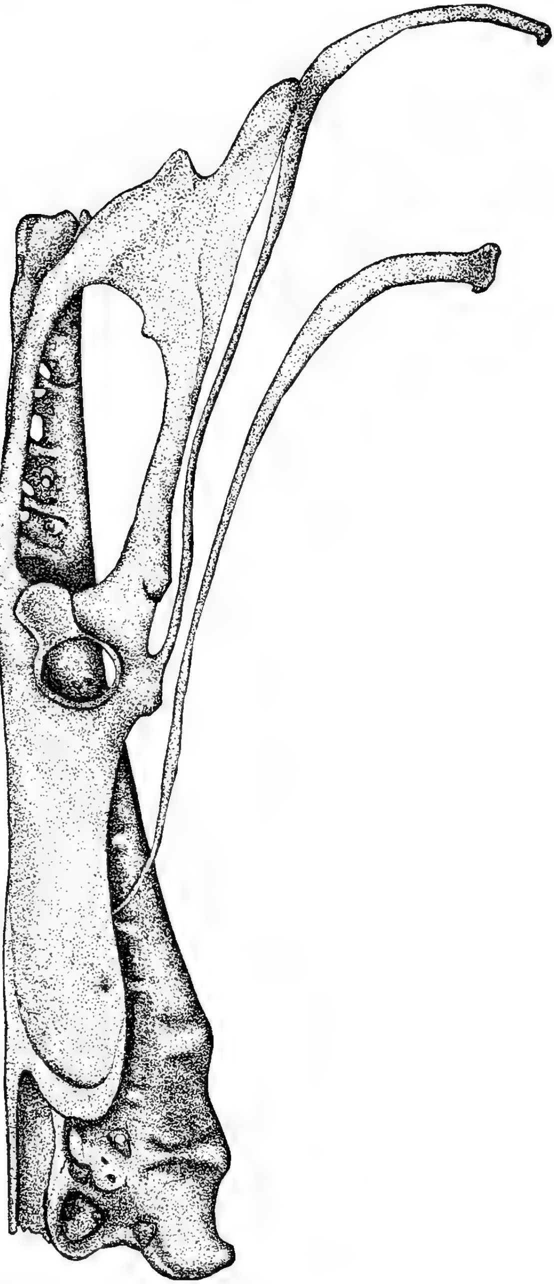


FIG. 31. Pelvis of *Sula bassana*, with sacral rib; left lateral view; life size. By the author, from the same specimen as shown in Fig. 24 *et seq*.

size just before arriving at a point opposite the end of the ischium. At this point it offers a small facet on its upper margin for the ischiac postero-inferior angle, and the two bones are in contact during life

The post-pubis then, retaining its increase in size, curves inward toward the fellow of the opposite side, to terminate in a cartilaginous tip.

The posterior border of this lateral aspect shows a well-marked ilio-

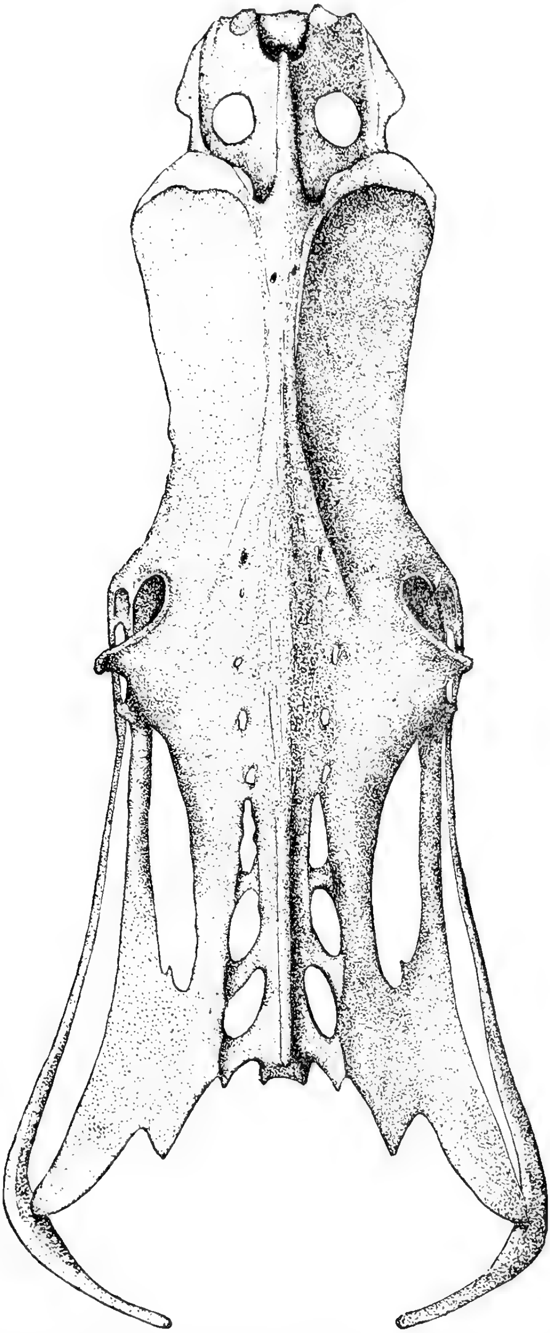


FIG. 32. Pelvis of *Sula bassana;* viewed from above; life size. By the author, from the same specimen seen in Fig. 24 *et seq.*

ischiac notch at about the middle of its extent. The outer side of the bone between it and the ischiac foramen is directed upward as well as outward.

As already mentioned above, there are eight free vertebræ in the tail, and a large pygostyle. The neural spines of these vertebræ are short and stumpy; some of them are bifid anteriorly; the neural arches beneath them close over the spinal canal for the entire length of the series, and it is seen to perforate, for a short distance, the pygostyle. The transverse processes are unusually thick and strong, being generally depressed, and in those segments where chevron bones occur they are anchylosed to the centra and hook forward over the preceding vertebra, after a fashion of many other birds wherein they are found.

On either end of any of the centra the facets show but little concavity or convexity.

The *pygostyle* (Fig. 37) appears to be composed of about six vertebræ, of which the three anterior ones can be quite easily made out. It has a very unusual form in this bird, being very long and subconical, with sharp superior border and rather decurved apex. Below, it is broad and somewhat convex. Viewing it from in front we notice that it has all the elements present, though in a very rudimentary state, of one of the caudal vertebræ, including a large, prominent, and anchylosed chevron bone.

OF THE APPENDICULAR SKELETON.

The pectoral limb.—We find the bone of the brachium to be somewhat longer than the radius and ulna in this limb, but the material before me will not permit me to say whether or no this holds true with Cormorants and Pelicans. In it the ulnar crest is prominent and projecting, though rather inclined to retreat from the elongated and shallow pneumatic fossa than arch over it, as in many other water birds. The radial crest is reduced to a long, low, inconspicuous ridge, and, in fact, this proximal end of the humerus, as a whole, merges into the shaft so gradually from both sides, and its being so narrow withal, that we are rather impressed with its lack of strength and an absence of a certain robustness so characteristic of other birds of equal size that lead a similar life. This in no way applies, however, to the shaft itself, for this subcylindrical and hollow bony tube, with its double sigmoidal curve, carries with it the very elements of strength and power.

Its distal extremity lacks but little of being as wide as the widest part of the head of the bone. It is without an ecto-condyloid process, has the trochleæ very prominent, and presents for examination a deep fossa to the anconal side of the ulnar tubercle.

The shaft of *radius* for so long a one is unusually straight, and only a slight curve is noticed in the proximal moiety of *ulna*.

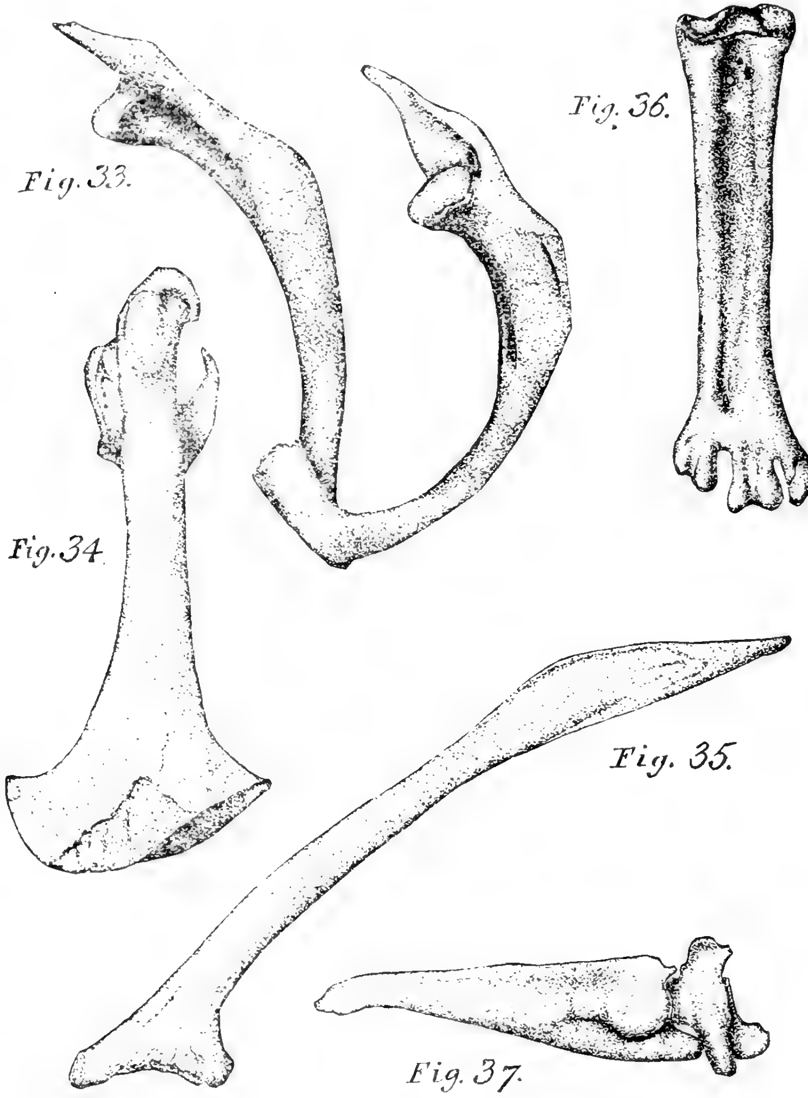
In its continuity the former bone is subtrihedral in its form, with its pneumatic foramina situated beneath the transversely expanded portion of the distal end. Muscular lines mark this radial shaft along its inferior aspect.

For its distal moiety the shaft of ulna is nearly cylindrical in form,

July 5, 1889.

but this is gradually exchanged for the subtrihedral as we pass over the proximal half of the bone.

It presents for examination a double row of feebly marked papillæ for the quill-butts of the secondary feathers.



Various bones of *Sula bassana*, from the same specimen as shown in Figs. 24 *et seq.*; all life size. By the author.

FIG. 33. The furcula, rotated outward, so as to show facets of articulation for heads of coracoids.

FIG. 34. Right coracoid, anterior aspect.

FIG. 35. Right scapula, outer aspect.

FIG. 36. Anterior aspect of right tarso-metatarsal bone.

FIG. 37. Right lateral view of pygostyle, together with last coccygeal vertebra.

A long, shallow, though notable, fossa is seen at the proximal and anconal side of the shaft, which terminates just beyond the prominent cup-shaped articulation for the ulnar tubercle of humerus in a single pneumatic foramen. This fossa has all the appearance of being intended

to lodge an air-sac, but the lack of fresh material prevents me from speaking positively upon this point.

Other pneumatic holes occur at the distal end of ulna upon all sides, except the outer one. The olecranon, though large and rather tuberous, would not particularly attract our attention.

A distinct canal upon the outer aspect of the distal end of the shaft for the passage of the tendons characterizes this bone. The articular surface shows nothing of special interest.

As usual, the carpal segments are but two in number—a *radiale* and an *ulnare.* They present the forms and facets common to these bones generally. Both are pneumatic and have large apertures for the admission of air to their hollow interiors.

The *carpo metacarpus* also presents a number of these foramina at either of its extremities; the principal one, however, is found just below the trochlear surface formed by os magnum upon the anconal side of the bone. A notable process occurs immediately below it, and another group of these air-holes to its outer aspect near the short and inconspicuous first metacarpal.

The main shaft is straight and of good caliber; it is longitudinally grooved nearly its entire length on the palmar side for a tendon going to the fingers. This is best marked upon the distal moiety of the bone. The metacarpal of middle digit is also straight for the major extent of its continuity; its extremities becoming enlarged in order to allow it to make the usual connections with index metacarpal. It is rather slender and develops no special processes, as it sometimes does in other representatives of the class.

The expanded portion of the proximal joint of index digit is not perforated, not even by the numerous pneumatic foramina which are irregularly scattered over its surface. Below it is produced as a notable

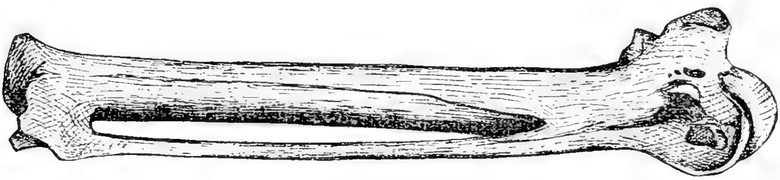


FIG. 38. Right metacarpus of *Sula bassana;* anconal aspect; life size. By the author, from the same specimen as shown in Fig. 24.

process, and a process that is seen in some of the extinct birds, as in *Ichthyornis*, for instance. The shaft of this phalanx is broad and flat anteriorly, and perfectly straight from above downward.

Equal to half the length of carpo-metacarpus, the distal phalanx of index digit is of a trihedral form, with an extensive excavation at the posterior aspect of its proximal end, which is continued in a lesser degree the entire length of the bone. It bears no claw below, but is finished off by a distinct little process.

Pollex phalanx has very much the same form as the one just described,

but it lacks the longitudinal excavation down its posterior aspect. Both of the bones are pneumatic. Lastly, we have the smallest phalanx of all belonging to the middle finger. This, as usual, is behind the broad proximal joint of index, and not quite equal to half its hinder border in length.

Of the pelvic limb.—In comparison with the general size of the Gannet this lower extremity is very short, though the bones composing its skeleton are none the less strong in consequence. In the *femur* we find the axis of the head and neck making an angle with the longitudinal axis of the shaft. The head is quite distinct, globular, and excavated as usual on top. Its surface is continuous with the broad articular surface which occupies the entire summit of the bone. No trochanterian ridge rises above this latter, and, indeed, this character of the femur is but poorly developed.

A pneumatic foramen is always seen at its most common site, on the anterior aspect, just below the superior articular surface.

The shaft is cylindrical, roughened in some places by lines and diffuse tuberosities for muscular attachment, bent slightly to the front and somewhat to the inner side. At its distal extremity the condyles are fashioned after the usual pattern among birds, but all their characters in *Sula* present sort of a lack of strong development. The fibular cleft is but faintly marked, the intercondyloid notch or fossa is shallow, and the ridges in front much rounded and inconspicuous.

Something of the same condition is extended to the proximal end of *tibio-tarsus* of the leg, though not to such a marked degree, I think. Here the cnemial process rises but slightly above the articular summit of the bone, and the pro- and ecto-cnemial ridges which descend below it soon merge into the shaft, and are, at the best, but indifferently developed.

The shaft of this bone is straight and smooth and somewhat compressed from before backward throughout. It offers a long ridge to the fibula and is broad across where it is found. The distal extremity of the bone evinces more character than the upper one. An oblique bridge to confine the extensor tendons is extended across the deep groove that contains them during life.

Nearly parallel with each other, the condyles are wide apart, prominent and convex in front, to become suppressed and low thin-crested behind.

The fibula has the usual form seen in birds, but is here particularly interesting from the fact that it does not anchylose with the shaft of the leg-bone until it arrives at the middle of its lower third, and even from this low point the remainder of the bone, including an oval "external malleolus," stands out quite prominently. This rare condition of things was pointed out also for *Urinator lumme.*

Sula bassana has a long oval *patella*, obliquely marked across its anterior surface by a groove for the tendon of the ambiens muscle. This

bone I have already figured in another connection. (Proc. U. S. Nat. Mus., Vol. VII, p. 327, P of Fig. E.)

Tarso-metatarsus in *Sula* is strikingly large in its proportions when compared with the other bones of the limb. In length it is a little more than half as long as tibio-tarsus, but being wider and broader it appears much more massive. (Fig. 36.)

Its hypo-tarsus presents three short, longitudinal elevations of unequal sizes. These inclose two tubular passages for tendons, and are grooved themselves besides. The back of the shaft is flat, but in front it is much scooped out above, where it shows two antero-posterior perforations.

At the distal extremity three large trochlear projections present themselves. They are separated from one another by wide clefts of about an equal depth. These trochleæ are placed nearly side by side, the middle one being the lowest down, the inner next, and the outer one the most elevated. Their median grooves are best marked behind, but in addition the internal trochlea presents a deep, vertical notch upon its outer aspect.

The usual arterial perforation pierces the bone above the cleft found between the outer and middle projections, a groove leading in to it from above.

Accessory metatarsal is rather an elongated bone, swung to the lower part of the shaft in the usual way by ligament.

The basal joint of hallux, which it supports, is comparatively more slender for its length than the other joints of the foot.

These latter are in number and arrangement for the three anterior toes the same as in the vast majority of the class. They present all the characters usually attributed to the phalanges of the podal digits in birds, and are well proportioned, both as regard their relative calibers and lengths.

NOTES UPON THE SKELETON OF PHALACROCORAX URILE.

Three or four years ago I published in "Science" an account of the osteology of this Cormorant, then called *P. bicristatus*. Professor Coues, in his "Key" to North American Birds, second edition, did me the honor to reproduce my figures from "Science," and I further added to them in an article on the patella of birds, which appeared in the Proceedings of the U. S. National Museum (Vol. VII, p. 325). Here I pointed out the unusual characters of the patella as they were to be found in the Cormorants, and gave a front view of this sesamoid in *P. urile*.

Cormorants are further noted for possessing, in common with *Plotus*, an osseous nuchal style (Fig. 39, *st. o.*), occupying a position corresponding to the ligamentum nuchæ of most mammals.

As in *Plotus*, from either side of this freely articulated style of the occiput the temporal muscles also arise. This little bone has been remarked upon by Owen, Brandt, Eyton, Garrod, and other eminent

ornithotomists. Garrod's paper on the "Anatomy of *Plotus anhinga*" is especially worthy of mention in this connection, and contains a great deal of matter of value relating to the structure of the Darters and Cormorants. (P. Z. S., 1876, pp. 335–345.)

The Cormorants have a median groove in the superior aspect of their fused palatines for the rostrum of the sphenoid. Upon Parker's authority, too, we find that in the "Cormorants an oblong ossicle lies on the commencement of the zygoma. It is large in *P. carbo* and small in *P. graculus*."

FIG. 39. Left lateral view of the skull of *Phalacrocorax urile*; life size. By the author, from a specimen in the Smithsonian Institution. *st. o.*, the occipital style.

For additional points in the skeleton of the *Phalacrocoracidæ* I must refer the reader to my article in "Science" referred to above (Vol. II, No. 41, p. 640), where figures of the sternum, shoulder-girdle, and other parts of the skeleton may be seen.

OBSERVATIONS UPON A SKULL OF PELECANUS FUSCUS.

Twenty-four years ago I collected on the north side of Indian Cay a fine old male of this species of Pelican. Its skull was duly saved and now forms a part of my private cabinet. From it I made the drawing that accompanies these remarks. Huxley, in his Classification of Birds (P. Z. S., 1867), presents us with an excellent under view of the skull of *Pelecanus onocrotalus*, but the side view of the same is very indifferently drawn and a little misleading in some of the minor details.

Measuring from the transverse cranio-facial groove we find the osseous superior mandible in this specimen to be somewhat less than four times as long as the remaining part of the skull. A vertical section made through the middle of the posterior third of this mandible at right angles to its long axis gives an elliptical figure, with the minor axis on the horizontal plane. The anterior two-thirds has a sharp lateral edge, while the extremity is armed with a powerful decurved hook. About half of the fore part of this enormous beak is compressed from above downward, a compression that is accompanied by a gradual widening of the bone to near the end, where it slopes in toward the hook in the median line.

The maxillo-palatines constitute a great spongy mass that fills up a

space anterior to the rhinal chamber. They unite in the median line, are bounded above by the premaxillary, below by the united palatines, while the anterior extremity of the maxillary fuses with the mass at about its middle on either side.

In form this maxillo-palatine mass is wedge-shaped, with the broad end anchylosed with the under side of the united nasal processes of the premaxillary.

Posteriorly its wall is composed of compact tissue, being at right angles to the longitudinal axis of the skull. It slants from the under side of the cranio facial hinge to the anterior margin of a median foramen, seen just anterior to the keel which is formed by the union of the palatines behind.

This posterior maxillo-palatine wall has a cleft in its lower two-thirds, while two conical pits, placed side by side, lined with compact osseous tissue, occupy its upper third. They have their bases opening in the rhinal chamber, and their apices are pierced by the small subcircular nostrils, one in each conical passage.

The hinder half of the jugal bar is compressed from side to side, slightly dilated, with its end crooked up, and in life simply bound to the upper and outer side of the quadrate.

The body of a *lachrymal* fuses completely with the cranial elements above, its upper surface assisting in forming the smooth superfices of the frontal region. From this portion it sends downward and slightly backward a descending process. This is composed of a cylindrical pedicel for its upper third and an antero-posteriorly compressed portion for the lower two thirds. It fails to reach the maxillary, its tip remaining free just above that perpendicularly compressed bar which passes immediately beneath it.

The interorbital septum is entire, with the exception of a semicircular perforation, which is immediately in front of the aperture in the anterior wall of the brain-case that gives egress to the optic nerves.

Each olfactory has a small foramen in either orbit at its usual site; the track for the nerve being a broad, shallow groove beneath the orbital vault.

The *mesethmoid* is very deep; its anterior border is sharp and thin. Commencing in the aperture of the angle between the pterygoidal shafts, it is carried directly upward and forward to the expanded portion beneath the roof of the cranio-facial region, the edge meeting the median division of the maxillo palatines (Fig. 40).

The lower fourth of this ethmoidal border is thickened and rounded for the articulation of the palatine and pterygoidal heads.

Coming, as usual, from the anterior apex of the basi-temporal triangle, the other portion of the rostrum is decurved and meets the point referred to above in the angle between the pterygoids.

A *quadrate* is a very large bone with a broad, triangular orbital process. Its mastoidal head can hardly be said to be divided into two, as

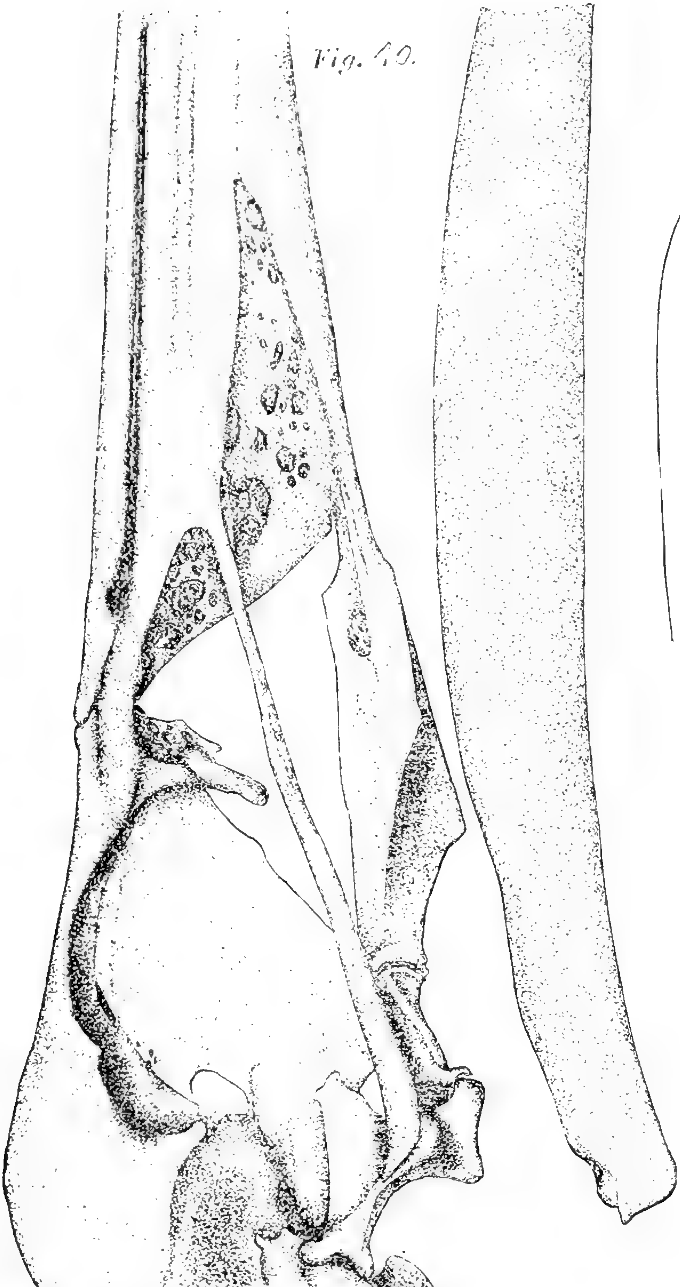


Fig. 41.

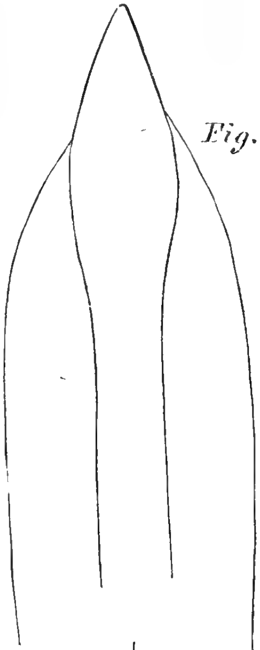


Fig. 42.

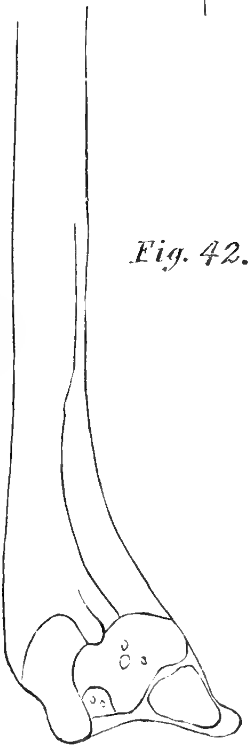


FIG. 40. Right lateral view of the skull and mandible of *Pelecanus fuscus;* anterior portion of mandibles not shown.

FIG. 41. Outline of anterior portion of superior mandible, viewed from above; horny sheath removed.

FIG. 42. Proximal extremity of left ramus, from above; drawn in outline.

All these figures life size. By the author, from a specimen he collected in the Bahama Islands in 1865, and at present in his private collection.

in most birds, and a large pneumatic foramen is seen upon its outer side—a very unusual place for this aperture.

Its mandibular foot is narrow antero-posteriorly and very wide transversely. Two facets occupy its lower surface, separated from each other by a concave notch which is deepest anteriorly.

The bone also presents a smooth articular surface for the quadrato-jugal at the point above mentioned, while a large convex facet is offered to the pterygoidal cup of the corresponding side.

We find the external opening to the ear to be very small, and hid from sight upon direct lateral view by the quadrate. A sphenotic process is well developed, but the mastoidal one is simply a roughened line; Between the two is a wide crotaphyte valley leading from the fossa of the same name, which is here small, inconspicuous, and entirely lateral.

The orbital cavity itself is thus seen to be deep and capacious, lacking bony walls principally upon its inferior and anterior aspects.

Upon its under side this skull presents a number of points of interest. The anterior moiety of the superior mandible is here seen to be longitudinally grooved by a broad and shallow furrow, which gradually becomes somewhat narrower as we proceed backward, to finally merge into the convex median portion of the hinder half of this great rostrum. Along its median line it is marked by a few scattered, slit-like foramina, that lead into its shallow interior, which latter is largely filled with an open mass of spongy, osseous tissue, continuous with the maxillo-palatines behind.

The palatine bodies, including their heads, fuse together for their entire extent in the median plane. Resulting from this union we have a single, descending, median carination, composed of the united inner keels of the palatine bodies and a similar superior median one composed of the ascending processes of the same.

The latter is truncated just before reaching the maxillo-palatine bodies.

This skull lacks basi pterygoid processes, while the pterygoids themselves are short, thick set bones, with large anterior and posterior heads, and sharpened longitudinal crests on the superior aspects of their shafts.

The basi-temporal triangle is small and its area concave. A thin, pointed lip of bone eaves over the entrance to the Eustachian tubes, which are here apparently thoroughly surrounded by bony walls.

We find the foramen magnum situated at the bottom of a broad, deep, and transverse concavity. This excavation is bounded on either side by the dome-like mastoid prominences, in front by the line of the base of the basi-temporal triangle, and behind by a low, smooth ridge which arches between its lateral boundaries.

The occipital condyle is rather large, ellipsoidal in form, and placed transversely, while the outline of the foramen is also a broad ellipse, but with its long axis placed just the other way. The plane passing

through its periphery makes an angle with the plane of the basis-cranii of about 60 degrees.

Regarding this skull from a superior aspect we are to note the small,

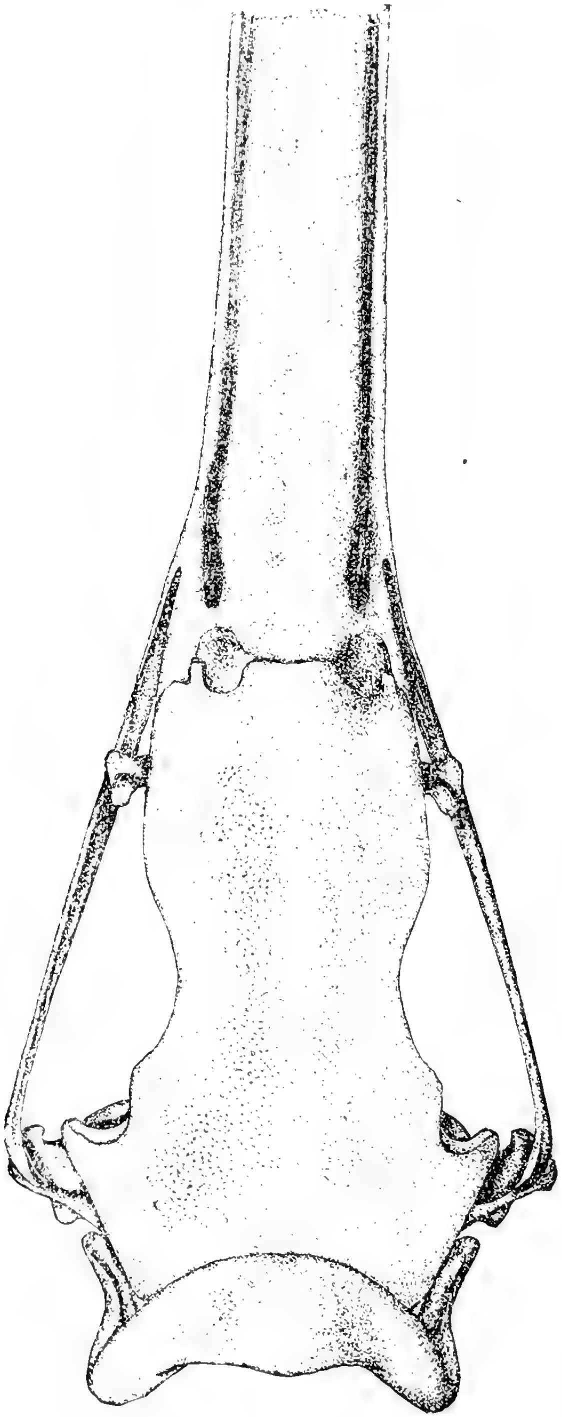


FIG. 43. Skull of *Pelecanus fuscus*; seen from above; mandible removed and anterior portion of superior mandible not drawn. Same specimen as given in Fig. 40; life size. By the author.

subcircular openings to the nostrils, situated a little beyond the irregular line marking the cranio-facial hinge. (Fig. 43.)

Their centers are about 2^{cm} apart, and each one is situated at the posterior end of a groove. These grooves extend the entire length of the superior mandible, passing out on either side of the hook at its anterior extremity. At first each is rather on the lateral aspect of the bone, but beyond the posterior half they gradually converge and get on top, to include between them the prominent convex culmen. Just before reaching the hook, however, the included surface becomes flat and depressed, when the lines terminate, as pointed out above.

Fig. 43 shows the form and direction of the cranio-facial line, and also the broad, smooth surface of the top of the skull in this Pelican. This is very flat for the frontal region, being simply curved downward at the outer borders. As we proceed backward to the parietal region, however, it gradually becomes more convex and dome-like, though still retaining its absolutely smooth and polished character. This latter may also be seen from a posterior aspect, and below it the high, arching, and equally smooth occipital area. This latter extends down on either side over the enormous mastoidal elevations of this bird. We also notice that from this view we may see directly into the foramen magnum; the entire pterygoids are in sight, and the quadrates come down far below the basi cranial plane.

The *mandible* from the skeleton of a Pelican is represented by a long, narrow loop of bone, which is strikingly devoid of prominent characters. Its symphysis is very short and decurved, being slightly excavated on its superior aspect behind.

The upper and lower margins of either ramus are rounded for their entire length, while the sides included between them become gradually narrower as we proceed in the direction of the symphysis. These are smooth both internally and externally and both concave in the vertical direction.

Rather more than the posterior moiety of each ramus is hollow for the admission of air, and each presents two foramina, which seem to be intended for that purpose. One of these is on the inner and upper aspect of the ramal shaft, just beyond a concavity that occurs immediately anterior to the articular cup. The other, elliptical in form, is on the inner and lower aspect, and about 2^{cm} beyond it.

Each articular cup presents two concavities—a central one and another occupying the inturned process of this extremity. Both have pneumatic foramina at their bases. The mandibular angle behind is truncate and much compressed in the perpendicular direction. The under surface of one of these ends is perfectly smooth and gradually merges into the inner and outer surface of the ramal shaft. Almost complete disappearance of the coronoids has taken place. Both the skull and its mandible are highly pneumatic.

DESCRIPTION OF A NEW SPECIES OF INSECT, FONTARIA PULCHELLA, FROM STRAWBERRY PLAINS, JEFFERSON COUNTY, TENNESSEE.

BY CHARLES H. BOLLMAN.

Fontaria pulchella, sp. nov.

Diagnosis.—Related to *F. oblonga** Koch, but the lateral carinæ smaller, and produced into a sharp point posteriorly; repugnatorial pore subinferior; ventral spine large, cylindrical, tapering, curved outwards.

Type.—U. S. Nat. Mus.; No. 404, Author's coll.

Description.—Brown, lateral carinæ and posterior border of segments red; legs and under parts yellow. Body very robust, anterior segment scarcely attenuated; smooth, with numerous short lines as in *castanea* and *tennesseensis;* papilæ less prominent. Vertex sulcus distinct; foveolæ single. Lateral carinæ small, margins swollen and produced posteriorly into a sharp point. Repugnatorial pore large, subinferior, subapical. Ventral plate armed; coxæ unarmed. Length, 20^{mm}; width, 4.3^{mm}; height, 4.2^{mm}.

Dr. Koch's figure of *Fontaria oblonga* represents a species which is more depressed, lateral carinæ larger, and the repugnatorial pores not subinferior, but on the upper side as in *castanea* or *tennesseensis.*

The white with which he says the lateral carinæ and posterior border of segments are colored is probably red, faded by bad alcohol.

This species is described from two females collected at Strawberry Plains by Mr. Charles B. Branner, of Mossy Creek, Tennessee.

INDIANA UNIVERSITY, *November* 1, 1888.

* *Fontaria oblonga* Koch, Syst. Myr., 142, 1847 (Pennsylvania).

ON A NEW SPECIES OF BUFO FROM TEXAS.

BY E. D. COPE.

Bufo aduncus, sp. nov.

This very distinct species has the cranial crests of the *B. lentiginosus* type, more especially resembling the *B. l. fowleri*. It differs especially from that species in the very short, wide head, with depressed muzzle overhanging the mouth; in the perfectly smooth inferior surfaces, and long legs, in the coloration, as well as in various minor details.

The head is wider than long, the width entering the length 2.25 times, while the length enters it 3 times. The entire profile is steeply decurved, and terminates in a prominent muzzle which projects considerably beyond the upper lip. The nostril is lateral and nearly terminal. The anterior lip border is below a point half-way between the nostril and the orbit. The maxillary bone is somewhat contracted to the lip border. The prefrontal bones are obtusely angulated above, but the cranial crests commence with the fronto-parietal bones. They are parallel and rather near together, and are well distinguished everywhere. They form a right angle with the postorbitals, beyond which they are not produced, nor is there any tendency to confluence posteriorly. A short, robust, supratympanic ridge. Orbit large; tympanic disk oblique, the long axis directed upward and forward, and a little shorter than the eye fissure. Skin above with small warts at considerable distances apart; below, everywhere smooth. Parotoids indistinct in the specimen, their inner borders strongly divergent from the middle line posteriorly. Limbs rather long. The muzzle marks the middle of the fore-arm, and the distal end of the tarsus, of the extended limbs. First finger longer than second. Second connected with first and third fingers by a short web. Palmar tubercle larger than usual. Toes closely bound together, the fourth considerably longer than any of the others. The internal cuneiform tubercle has a free edge which is not black; the external tubercle is small. The femur is bound to the middle by the skin of the side of the body.

Measurements.

	M.
Length of head and body	.044
Length of head to end of crests	.0105
Width of head at canthus oris	.0195
Width of head between orbits	.003
Length of fore-leg	.029
Length of fore-foot	.012
Length of hind leg from ilium	.061
Length of hind foot	.028
Length of hind foot less tarsus	.019

The general color above is rather light lead colored, and below clean yellowish white. The small warts above are red, with a black ring at the base. No median dorsal band. A light band commences on the scapula and extends nearly to the groin. It is bounded above by separate blackish spots, and below by similar spots which are closer together. These form the superior border of a lead-colored band. This disappears below in a crowd of small black spots, which grow smaller and disappear on the sides of the abdomen. The integument thus marked is areolated. All the lighter parts of this region are dotted with pink spots. Posterior faces of fore-arm, femur, tarsus, and external metatarsi blackish with small yellow speckles. The limbs have on their upper surfaces brown cross-bands with pink points in them. Anterior face of tarsus with a brown spot, and several on the external digits.

Catalogue number.	No. of specimen.	Locality.	Collector.	Nature of specimen.
14100	1	Texas*	G. H. Ragsdale.	Alcoholic.

* Unfortunately without nearer indication of locality, but probably from near Gainesville, which is in northern Texas, near the Red River.

This species is well characterized by the length of its legs, the short and peculiar form of its head, the smoothness of its lower surfaces, and the color.

ON THE PROPER GENERIC NAME OF THE TUNNY AND ALBICORE.

BY THEODORE GILL.

In 1817, in the first edition of the Régne Animal, Cuvier proposed two subgenera of *Scomber*, which he employed, however, in a generic sense; one, *Thynnus*, was based upon the common Tunny (with which were associated other and smaller species), having moderate pectoral fins; and the other, *Orcynus*, was based upon the *Alalonga* of the Mediterranean, and characterized by the long pectoral fins. Subsequently, by many ichthyologists, these two genera were combined into one, under the name *Thynnus*. In 1861 the present writer replaced the name *Thynnus* by the term *Orycnus*, which was substituted, inasmuch as *Thynnus* was used for a genus of hymenopterous insects by Fabricius in 1775. This name *Orycnus* was simply due to a misreading of the name *Orcynus*, and was subsequently replaced by *Orcynus* in its correct form. Nevertheless, in 1863, Dr. J. G. Cooper, in the "Proceedings of the California Academy of Natural Sciences" (vol. 3, p. 77), proposed to revert to the old groups of Cuvier in the following terms, describing a supposed new species, related to the Alalonga of the Mediterranean, which he called *Orcynus pacificus*:

"This species is one of several confounded by sailors under the Spanish names of Albicore and Bonito. The English name Tunny is applied to an allied species on the coast of Europe, the *Thynnus vulgaris*, Cuv., and to its near representative, the *T. secundi-dorsalis*, Storer, of the eastern American coast. These, however, are evidently of a different genus, and as *Thynnus* is pre-occupied in insects, the name *Orycnus*, applied by Gill to the same type, may perhaps be retained, although *founded on a mistake*."

Without reference to the reality of what was so evident to Dr. Cooper, we need only recall that here the name *Orycnus* was specifically proposed to be retained, at the same time that *Orcynus* was used for a related genus.

In 1888, Professor Jordan, in the "Proceedings of the Academy of Natural Sciences of Philadelphia" (reprinted in the "Annals and Magazine of Natural History" for 1888), apparently overlooking this specific application of the name *Orycnus* by Cooper, proposed the new name *Albicora* for the same genus, inasmuch as *Orcynus* had been used in 1815 for a genus of Carangids by Rafinesque, while *Thynnus* of Cuvier, as is well known, had been pre-occupied for a genus of hymenopterous insects.

The present author would have been glad if the name *Orycnus* could have fallen into "innocuous disuetude" but inasmuch as it had been

specifically and with *malice prepense* resurrected and proposed for retention by Cooper, it must surely be retained for the genus comprising the Tunny and Albicore. It belongs to a category of which there are many illustrations, being an anagram of another name, and numerous such have been proposed deliberately and generally adopted, such as *Panulirus* and *Linuparus*, anagrams of *Palinurus*, and various others.

If it is represented that the word *Orycnus* is merely due to a slip of the pen or typographical error, and therefore should not be retained, we can, in reply, refer for an analogous retention of an incorrect form to no less an authority than Professor Jordan. In the fifth edition of his excellent work, "A Manual of the Vertebrate Animals of the Northern United States," published a couple of months ago (1888, p. 92), we find the word *Athlennes*, which was originally proposed in 1886 as a designation for the *Belone hians* of Cuvier and Valenciennes. As we suspected at the time of publication, this name is really derived from an ancient Greek synonym of the common *Belone belone* of Europe, "αβλεννης, without mucosity."

Nevertheless, in a foot-note to the Manual we are informed that "this name was inadvertently printed '*Athlennes*,' and may remain so; '*Ablennes*' was intended." Surely, then, in strict analogy with such usage, the name *Orycnus* can be retained as the generic designation of the Tunny.

ON THE PSYCHROLUTIDÆ OF GÜNTHER.

BY THEODORE GILL.

(With Plate XLI.)

HISTORICAL.

In 1861 Dr. Albert Günther, in the third volume of his "Catalogue of the Acanthopterygian Fishes in the collection of the British Museum" (p. 516), proposed a family *Psychrolutidæ* in the following terms:

"Body rather elongate, naked; head large. Teeth small. A single dorsal fin on the tail, without spinous portion; anal similarly developed as the dorsal; ventrals close together, thoracic, composed of a few rays. Three gills and a half; pseudobranchiæ well developed. Gill-opening of moderate width, the gill-membranes attached to the isthmus.

"West coast of North America.

"The new fish for which I have created this family exhibits several characters indicating its natural affinity to the *Discoboli* and *Gobiesoces*, which are Acanthopterygians as this Order is understood at present. It is impossible, however. to refer it to one of these or of the other families without giving up the chief characters on which they are founded. It agrees—

"1, With *Blenniidæ* in the structure of the ventral fins, but is distinguished by the position of these fins and by the total absence of the spinous dorsal.

"2, With the *Discoboli*, and especially with *Liparis* in the structure of the infraorbital bone, in the integuments of the body, &c., but differs from them in the dorsal and ventral fins.

"3, With the *Gobiesoces* in the structure of the dorsal fin, but having no adhesive apparatus.

"4, It differs from the *Batrachidæ* and *Pediculati* in the dorsal and ventral fins, in the gill apparatus, &c.

"1. PSYCHROLUTES.

"Characters the same as of the family."

In the same volume Dr. Günther, in a "systematic synopsis of the families of the Acanthopterygian fishes" (p. ix), exhibited the relations of the fishes, supposed to exist at that time, in the following scheme:

Fourteenth division, *Acanth. gobiesociformes*.

No spinous dorsal; the soft and the anal short, or of moderate length, situated on the tail; ventral fins subjugular, $\frac{1}{5(4)}$, with an adhesive apparatus between them, or entirely absent. Body naked.

I. An adhesive apparatus between the ventrals.

42. Gobiesocidæ, III, p. 489.

II. Ventrals none.

43. Psychrolutidæ, III, p. 516.

Sig. 21. July 5, 1889.

The family and genus thus indicated were established for a single small fish, named *Psychrolutes paradoxus*, twenty-one lines in total length, obtained in the Gulf of Georgia during the voyage of H. M. S. *Plumper*.

In 1876 Captain Hutton, in the "Transactions and Proceedings of the New Zealand Institute" (Vol. VIII, p. 214), described a fish then recently found at New Zealand as *Psychrolutes latus*, considering it to be generically related to the North American fish.

In 1876 Dr. Albert Günther, in "The Annals and Magazine of Natural History" (4), Vol. XVII, p. 395, established for the New Zealand fish a peculiar genus, to which he gave the name *Neophrynichthys*, and assigned the following characteristics:

"Head broad and depressed; skin naked. Canine teeth none; palate smooth. Gill-covers without spines. Two dorsals, the first formed by nine flexible spines. Ventrals close together, thoracic, rudimentary. Three gills and a half; pseudo-branchiæ. Gill-opening extending to the lower angle of the pectoral."

On this form he commented as follows:

"One specimen 6½ inches long, from Dunedin, obtained from the Otago Museum. This fish has been named by Captain Hutton *Psychrolutes latus;* and from a careful comparison with *Psychrolutes paradoxus*, I can confirm the correctness of his view as regards the affinity of these two fishes; but the presence of a well-developed first dorsal appears to me to demand the separation of the New-Zealand fish into a distinct genus. The discovery of this fish led me to reconsider the position which the family Psychrolutidæ ought to take in the system. As the absence of the first dorsal can not be retained as one of the characters of the family (which would connect it with the Gobiesocidæ) I think those fishes ought to be removed from the division of *Gobiesociformes* to that of the *Cotto-scombriformes*, where it would follow the Batrachidæ."

He corrected the reference of the Psychrolutidæ to the Gobiesociformes in a foot-note (p. 396), as follows:

"In my systematic synopsis of the families of Acanthopterygian fishes a misleading error has crept in (p. ix), the family Psychrolutidæ being characterized by 'Ventrals none' instead of 'No adhesive ventral apparatus.' Also the diagnosis of the fourteenth division should be corrected by striking out the words 'or entirely absent.'"

Dr. Günther, in 1881, in the "Proceedings of the Scientific Meetings of the Zoological Society of London" for the year 1881 (p. 20, pl. I), noticed and published a plate of a fish obtained in Swallow Bay, Magellan's Strait, which he referred to *Neophrynichthys latus* in the following terms:

"Of this very interesting fish, which was discovered only a few years ago by Mr. Hutton in New-Zealand, a specimen 16 inches long is in the collection. Fortunately, by the kindness of Mr. Hutton, I am in a position to compare the American specimen with the one obtained on the

New-Zealand coast. Structurally they are identical; only some tentacles are developed in the American specimen above the eye and on some parts of the body. The coloration is a blackish-brown, marbled with lighter brown and gray. These differences are not sufficient to indicate specific distinctness. The specimen was obtained in Swallow Bay, Magellan's Straits."

Finally Dr. Günther, in 1880, in his "Introduction to the Study of Fishes," (p. 469), interpolated the family Psychrolutidæ between the families Batrachidæ and Pediculati.

In 1882, Professors Jordan and Gilbert, in their "Synopsis of the Fishes of North America" (pp. 683, 686), identified a fish from Kodiak, Alaska, with the *Psychrolutes paradoxus*, and gave their views as to the relationships of the genus, differing entirely from Dr. Günther as to such relationships. They considered the genus *Psychrolutes* to be composed of "small fishes, closely resembling *Liparididæ*, from which group they are distinguished by no character of much importance," and referred the genus to the family Cottidæ, associating it with the genus *Cottunculus* in a subfamily Psychrolutinæ, which they proposed for the Cottidæ with "ventral fins present, spinous dorsal little developed, continuous with the soft dorsal, the spines slender, concealed in the loose, naked skin, gill-membranes loosely joined to the isthmus, no slit behind last gill" (p. 683).

Professors Jordan and Gilbert have specifically attributed to *Psychrolutes* a "suborbital stay narrow, not reaching preopercle."

If the identification of Professors Jordan and Gilbert had been correct, the material would now be at hand for a comparison of the genera *Psychrolutes* and *Neophrynichthys*, but if the description of Dr. Günther is reliable, the identification has been erroneous. (1) The spinous dorsal was externally invisible in the type so that it was denied, in the diagnostic phrase, "a single dorsal fin on the tail, without spinous portion," whereas, in the specimen of Jordan and Gilbert, the spinous dorsal is conspicuous, although covered by skin; (2) the eye in the type has a diameter only "about one-seventh of the length of the head, one-half of that of the snout," while the eye in the Kodiak fish is about one-fourth the length of the head and about equal to that of the snout; (3) the ventrals in the type are "composed of two rays, the inner of which is bifid," while the Kodiak fish has, apparently, a spine and five rays. The Alakan fish is in poor condition, and it does not seem advisable to allocate it until the typical *Psychrolutes* is re-examined. But, although the fishes described under the same name by Günther and Jordan and Gilbert appear to be distinct,* they may be allied, and the specimen described by the latter may thus be made serviceable in the inquiry as to the relations of the type.

* Dr. Bean informs me that he has himself distrusted the identification of the specimen described by Jordan and Gilbert, now in his custody, with the *Psychrolutes paradoxus*.

Several questions remain to be determined with respect to the representatives of the fishes thus noticed: (1) What are the relations of the respective genera? (2) What are their characteristics? (3) Are the fishes of New Zealand and South America the same? The possession by the National Museum of the specimen described by Jordan and Gilbert as *Psychrolutes paradoxus* and an authentic one of *Neophrynichthys latus* permit a comparison of the two types, but, being unique to the Museum, the rules do not permit their dissection. The questions can therefore be in part, and only in part, elucidated.

I.

The characteristics that have been given as differentiating the genera *Psychrolutes* and *Neophrynichthys* probably do not exist in nature. As Professors Jordan and Gilbert have shown, a spinous dorsal is really developed in their *Psychrolutes;* there is a spinous dorsal of short, slender flexible spines imbedded in the skin and scarcely visible. There are eight of these spines. On the other hand, the distinctness of the spinous dorsal in *Neophrynichthys* has been exaggerated. In that genus the spinous dorsal is obscure, externally, as in *Psychrolutes*, and it is only when the skin is upraised that the spines can be seen and enumerated. There is in this respect probably no difference between the typical *Psychrolutes* and *Neophrynichthys.*

In fact, the two genera appear to be nearly related, but the relations of neither are with the Gobiescoidæ or any other form to which Dr. Günther has approximated them. Nevertheless, the genus *Neophrynichthys* manifests a decided general resemblance to a Batrachid both in physiognomy and the loose skin with which the body and fins are invested, and it is not at all surprising, and, indeed, quite natural, that a superficial observer who merely looked at the outside should be misled by the resemblance and refer the family next to the Batrachids. As has been already pointed out, however, it is with the *Cottidæ* alone that we have to compare them. If the skin is cut and lifted up from the cheek of *Neophrynichthys*, a distinct suborbital stay is revealed; that stay is undoubtedly, as in the case of *Cottidæ* generally, the enlarged third suborbital bone, and, likewise, as in the *Cottidæ*, it obliquely crosses the cheek and is attached to the inner angle or margin of the pre-operculum in the manner that is characteristic of those fishes. The genus *Neophrynichthys* and consequently also the genus *Psychrolutes* must be referred to the neighborhood of the *Cottidæ*. Whether the two genera really belong to that family can not be ascertained until an examination is made of the skeleton. It is quite possible that they may then prove to really represent a peculiar family. But in the mean time, while no characters of anything like family value are apparent, it is advisable to follow in the footsteps of Professors Jordan and Gilbert and associate them with the *Cottidæ*. In that family, however, we can isolate them in a distinct group or subfamily under the

name *Psychrolutinæ*. That subfamily will only include the two genera in question, *Cottunculus*, which has been referred to it by Professors Jordan and Gilbert, appearing to be more closely related to the typical *Cottidæ*. The superficial characters of the subfamily are given in the concluding synopsis.

II.

The generic differences between the genera *Psychrolutes* and *Neophrynichthys* can only be certainly ascertained when a typical *Psychrolutes* can be re examined.

III.

The relation of the fishes of New Zealand and South America, considered to be conspecific by Dr. Günther, remains for consideration.

The *Neophrynichthys latus*, as described by Captain Hutton, Mr. W. Arthur, and Dr. Günther, is a fish about 7 inches long, exceptionally attaining a length of 9 inches; it has no conspicuous tentacles; its color is noticeable for the distinct roundish or oval spots which cover the body and head, and extend more or less upon the fins. (The color is noticed more at length in the specific diagnosis.) The species is quite uniform in respect to coloration, as Hutton, Günther, and Arthur essentially agree respecting it, and other descriptions are corroborated by the specimen under examination. Inasmuch as the specimens which Dr. Günther and the present writer have observed are derived from New Zealand naturalists,* it is presumable that there is no essential difference between them and any of the others that have been found. Consequently, the color may be said to be generalized from about a dozen individuals at least. The South American fish referred to *Neophrynichthys latus* is, however, very different. A single specimen obtained during the survey of H. M. S. *Alert*, in Swallow Bay, Magellan's Straits, is 16 inches long. The coloration is a blackish-brown, marbled with a lighter brown and gray; small branched tentacles are represented as being developed above on each side of the snout and along the roofs of the orbits, as well as in a row along the preoperculum and scattered over the body.

According to Dr. Günther, these differences are not enough to indicate specific distinctness. In our own opinion they are amply sufficient to indicate such differences, especially in view of the uniformity in size, coloration, and absence of tentacles which distinguishes the *Neophrynichthys latus* of New Zealand. In addition to the differences alluded to by Dr. Günther, if we can place any reliance on the plate accompanying that gentleman's communication, the South American fish dif-

* The specimen in the U. S. National Museum was sent by Professor Parker, of Otago, who has made several excellent contributions to our knowledge of New Zealand fishes.

fers very much from the New Zealand one in the contour of the head, size of the eyes, the distinctness of the spinous dorsal, and the development and form of the soft dorsal, anal, and caudal fins, as well as of the pectoral. In a fish of this type, in which the skin so loosely invests the body and head, wide difference in form may be assumed, but it is scarcely likely that the artist should have so misrepresented such a fish as *Psychrolutes latus* as would be the case if the figure published by Dr. Günther is correct. A simple comparison between the figure in Dr. Gunther's communication and that of the New Zealand fish herein given will serve to show the differences; the accompanying figure has been very carefully drawn from the fish placed in natural position, and it will be found difficult to believe that there is a specific identity of that fish and the one illustrated by Dr. Günther. We have, therefore, no hesitation in differentiating the South American from the New Zealand fish and in giving to it a new name. The question for further investigation will be, in fact, rather whether the two fishes do not belong to different genera.

IV.

The results thus detailed may be summed up in the following synopsis, briefly recapitulating the characteristics of the subfamily *Psychrolutinæ*, and the species *Neophrynichthys*. We may hope that perhaps Professor Parker, to whom we are indebted for excellent memoirs on the anatomy of several fishes of his adopted home, may give himself, or depute a student to give us, some details as to the anatomy of a fish which does not appear to be excessively rare in New Zealand.

SUBFAMILY PSYCHROLUTINÆ.

Cottidæ with ventral fins thoracic, rather close together, and each rising from a pocket-like fold of the skin, little developed, and composed of one spine very feebly developed, and one or more rays; with a spinous dorsal little developed and more or less continuous with the soft; the spines slender; the head and the entire body invested in a loose skin, which conceals all cephalic prominences and encroaches on the fins, almost entirely concealing the spinous dorsal and enveloping the soft vertical fins nearly to the tips of the rays; the branchial apertures confined to the sides and separated by a very wide isthmus, formed by the continuous skin between the chin and the abdomen.

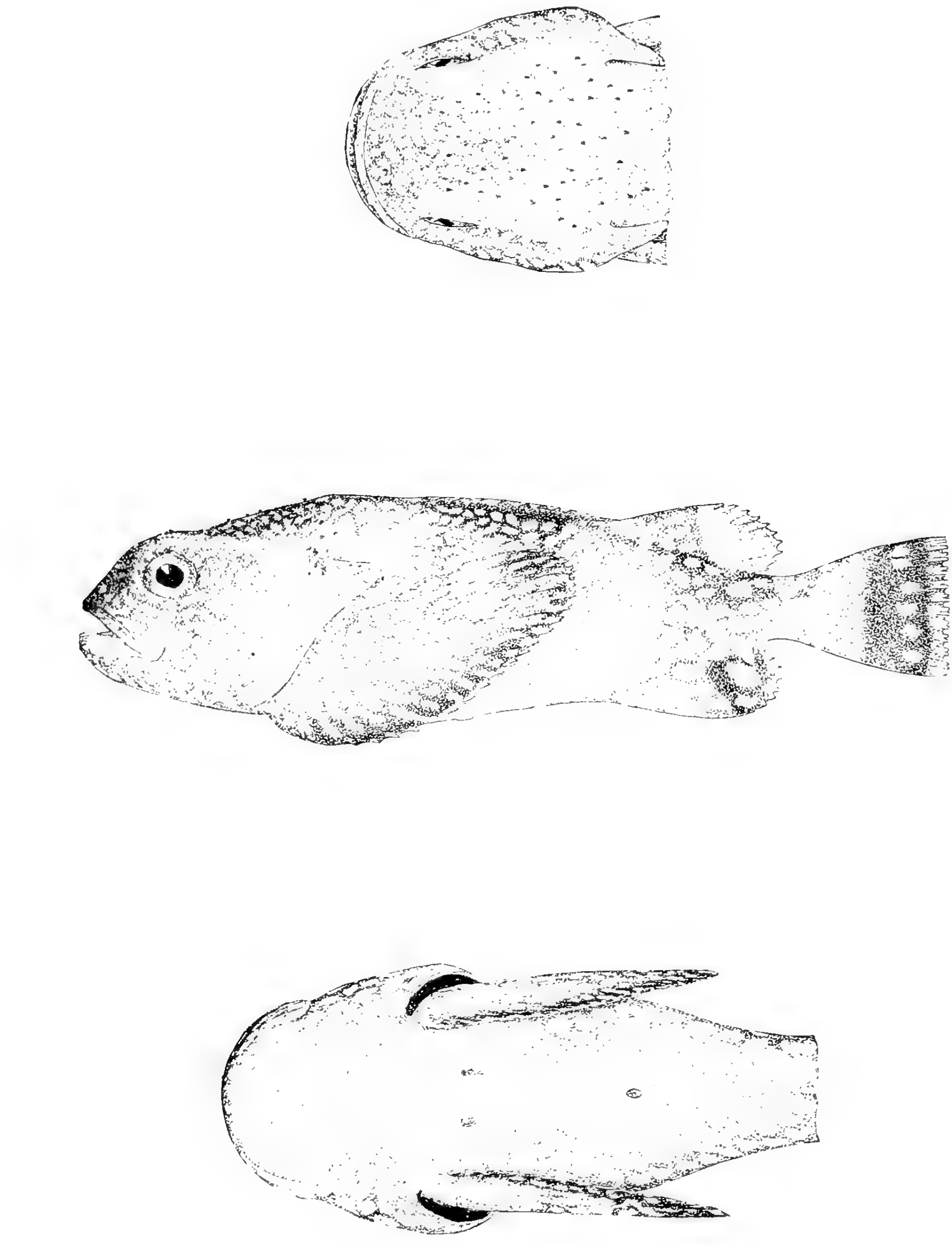
PSYCHROLUTES.

Psychrolutes paradoxus.

Psychrolutes paradoxus Günther, Cat. Fishes, B. M., vol. 3, p. 516, 1861.

Psychrolutes of a dusky color, pale below, about 2 inches long.

Habitat.—Pacific coast, North America (Kodiak; Gulf of Georgia).



NEOPHRYNICHTHYS LATUS. (Page 327.)

NEOPHRYNICHTHYS.

Psychrolutinæ, with the preopercular surface near the posterior edge entire and merely striated.*

Neophrynichthys latus. (Pl. XLI.)

Psychrolutes latus Hector, Trans. New Zealand Inst., vol. 8, p. 214, 1876.

Neophrynichthys latus Günther, Ann. and Mag. Nat. Hist. (4), vol. 17, p. 396, 1876.

Neophrynichthys latus Arthur, Trans. New Zealand Inst., vol. 17, p. 166, Pl. 14, figs. 5, 5*a*, 1885.

Neophrynichthys with the "color dark brown on head and trunk, somewhat lighter on belly, with more or less distinct [black] bands around margins of the fins, which are white-tipped (the band is plainest in the caudal fin); a row of salmon-colored spots around margin of posterior dorsal and pectoral fins, and numerous round, oval spots of same color scattered all over head, trunk, and fins," with short, simple, black tags scattered on the roof of the head, but no other cutaneous appendages; averaging about 7 to 8 inches in length.

Habitat.—Coast of New Zealand.

The color of this species seems to be quite constant. The diagnosis incorporates the description of Mr. W. Arthur, who had "several" specimens for examination, and that description is quite applicable to the specimen in the U. S. National Museum. Professor Hutton has simply noticed the color as being "dark grayish-brown, irregularly *spotted with white*," and Dr. Günther has indicated it as being "brown, covered all over with round whitish spots."

Neophrynichthys marmoratus.

Neophrynichthys latus (part) Günther, Proc. Zool. Soc. London, 1881, p. 20, Pl. 1.

Neophrynichthys with the color "blackish-brown, marbled with light brown and gray," and with ramose cirri (1) in a row on each side of the snout, ending behind over the orbits; (2) in a row on the operculum parallel with its margin, and (3) scattered over the caudi-trunk (trunk and caudal region); about 16 inches long.†

Habitat.—Coast of Patagonia.

---

* The Psychrolutes of Jordan and Gilbert has, near the margin of the preoperculum, a deep furrow crossed by several horizontal bars or bridges.

† The only specimen known is 16 inches long. What may be the average of the adult remains to be ascertained.

ETHNOLOGY OF THE COAST INDIAN TRIBES OF ALASKA.

BY ENSIGN A. P. NIBLACK, U. S. N.

The strip of coast territory extending from Puget Sound to Cape Saint Elias and bordered on the east by the Cascade range of mountains, known in general as the Northwest Coast, is a continuous archipelago about 1,000 miles long and 150 miles broad. Through its narrow channels winds the steamer route to Sitka, and dotted along its shores are the picturesque winter villages of the Coast Indian tribes, an ethnic group, corresponding to one of Bastian's geographical areas, materially differing not only from the hunting Indians of the interior, but in themselves presenting some of the most interesting problems in anthropology. The northern Indians of this region, comprising the Tlingit, Haida, and Tsimshian, may be called the wood-carving group; and the southern Indians, the Kwakiutl, Wakashan, and Coast Salish, the cedar-bark group, such designations being based on the peculiarities of each in the use of wood and cedar-bark, respectively, for industrial, ceremonial, and other purposes.

There have been three semi-official estimates of the Tlingit tribes of Alaska. The earliest is that in the archives of the Hudson Bay Company under Sir James Douglas (1839), made by Mr. John Work, a factor of the company. The total as given, including the Kaigani tribes of the Haidan stock, and adding on the Sitka and Hoonyah, which were omitted, is 8,975. In 1861 Lieutenant Wehrman, of the Russian Navy, in the employ of the Russian-American Company, compiled a census of Tlingit and Kaigani, giving the total population of free and slaves as 8,597. The third estimate appears in the Census Report of 1880, and places the Tlingit and Kaigani population at 7,225. That the enumeration is faulty goes without saying, when no real attempt was made to actually count them. What is needed is a census taken in the winter when the Indians are gathered in the villages, and it should include the enumeration of the different sub-totems and totems composing the great phratries of these tribes. This should be supplemented by an accurate plotting of the Indian hunting and fishing grounds which have been held in the different families and handed down for generations. A collection of the various myths and traditions, with all the local variations, and a stuy of the significance of the carved wooden columns in the villages is also needed to throw light upon their intricate totemic system. The semi-religious sects and the elaborate ceremonials and dances would in themselves constitute a special branch of study. In the U. S. National Museum is a magnificent collection of ethnological material from this region. What is needed is a systematic governmental supervision of the collection of anthropological data, and a comparison of re-of results with those obtained in the southern portion of this region

LIST OF FISHES COLLECTED BY ALPHONSE FORRER ABOUT MAZATLAN, WITH DESCRIPTIONS OF TWO NEW SPECIES—HEROS BEANI AND PŒCILIA BUTLERI.

BY DAVID STARR JORDAN.

In the year 1885 a considerable collection of Mexican fishes was sent to the U. S. National Museum by Alphonse Forrer, a collector then stationed at Mazatlan. I am indebted to the courtesy of Dr. G. Brown Goode, Director of the National Museum, and to that of Dr. Tarleton H. Bean for the opportunity to study this interesting collection. The marine species are from Mazatlan or the Tres Marias Islands; the fresh-water forms from the Rio Presidio, near Mazatlan. The following is a list of the species:

1. **Sphyrna zygæna** (L.) 37162, a fœtus. Mazatlan.

2. **Galeus lunulatus** (Jordan & Gilbert.) 37163. Mazatlan.

3. **Tachysurus jordani** Eigenmann & Eigenmann. 39905. Rio Presidio. One specimen.

This specimen belongs to the species which we at first wrongly called *assimilis*, later identified by me as the *seemani* of Günther. Eigenmann* has given it a new name, *jordani*, regarding it as distinct from Günther's species. In this specimen the head is 4 in length; the groove of the fontanelle extends just to the base of the occipital keel.

4. **Tachysurus guatemalensis** (Günther.) 37144. Rio Presidio.

A young specimen, agreeing with the account given by Jordan & Gilbert, except that the head is 4 in length.

5. **Tachysurus cœrulescens** (Günther.) 39906. Rio Presidio. Two young specimens.

Space between eyes smooth and flat; fontanelle with a very slight groove, which does not reach nearly to the occipital process; the process

*In a letter to me Mr. Eigenmann thus compares the two species, *seemani* and *jordani*.

From specimens about the same size (both ♂ and ♀ of *seemani*) we made the following comparison:

T. seemani.	*T. jordani.*
Head flat, depressed in front; snout scarcely decurved; occipital keel bluntish; eye 7 in head, $3\frac{3}{5}$ in interocular; granulations about the head coarse, conspicuous.	Head scarcely depressed, the snout strongly decurved; occipital keel sharper than in any other species; eye 5–$5\frac{1}{2}$ in head, $2\frac{3}{4}$–3 in interocular; granulations about the head less distinct than in *seemani;* palatine patches of teeth much smaller.

with a moderate keel. Band of palatine teeth quite short and small. Barbels very long, the maxillary barbel reaching middle of pectoral. Pectoral spine $1\frac{1}{3}$ in head.

6. **Pœcilia butleri**, sp. nov. 37158. Rio Presidio. Six specimens.

Allied to *Pœcilia dorii* Günther, but with deeper body and larger scales. Head $3\frac{1}{5}$ to $3\frac{2}{3}$ in length to base of caudal; depth $2\frac{3}{4}$ (adult) to $3\frac{1}{3}$ (young). D. 9, A. 8. Scales 23 to 25. Length of adult 2 inches. Origin of dorsal midway between base of caudal and front of eye and over tenth scale of lateral line; fins moderate, longest ray of dorsal about as long as head without snout; caudal scaly at base; caudal peduncle compressed and deep; color uniform olive, the young with faint dark cross-shades; caudal with a few black spots; dorsal with numerous round black spots in both sexes.

This species is described from five male and one young female specimens taken in the Rio Presidio, near Mazatlan. It is named for my friend Mr. Amos W. Butler, Secretary of the Indiana Academy of Sciences.

7. **Mugil curema** Cuv. & Val. 37161. Mazatlan.

8. **Centropomus robalito** Jordan & Gilbert. 37148 (3). Rio Presidio.

9. **Holocentrus suborbitalis** Gill. 37153 (6). Young specimens, the largest 4 inches long. Tres Marias Islands.

10. **Bairdiella icistia** (Jordan & Gilbert). 37147. Rio Presidio.

11. **Gerres peruvianus** Cuv. & Val. 37146 (2). Rio Presidio.

12. **Gerres lineatus** (Humboldt). Rio Presidio.

Pectoral one-sixth longer than head, not reaching front of anal; depth 2 in length. Anal dusky. This species is scarcely different from *Gerres brasilianus* (=*Gerres patao* Poey) of the Atlantic.

13. **Upeneus dentatus** Gill. 37157. Tres Marias Islands.

A large specimen, much the largest known. Length $10\frac{3}{4}$ inches; eye large, $3\frac{1}{5}$ in head; scales 37; teeth all small.

14. **Hæmulon sexfasciatum** Gill. 37151. Tres Marias Islands.

15. **Pomadasis macracanthus** (Günther). 37160. Mazatlan.

16. **Lutjanus viridis** (Valenciennes). 37150. (*Diacope viridis* Valenciennes. Voyage de la Vénus, Zool. 303, Pl. I, Fig. 2, very bad.) Tres Marias Islands.

The rediscovery of this lost species is a very interesting addition to our knowledge of the fishes of tropical America.

Head $2\frac{2}{3}$ in length ($3\frac{1}{3}$ with caudal); depth, 3 ($3\frac{2}{3}$). D. X, 14, A. III, 8. Scales (7) 9–54–17. Length, 8 inches. Body comparatively elongate, the back not strongly compressed and little elevated; profile from snout to nape almost straight, thence gently and regularly curved to end of dorsal. Snout pointed, $3\frac{1}{4}$ in head; supraoccipital keel little

prominent; preorbital moderate, its least width $6\frac{2}{3}$ in head. Mouth moderate; jaws subequal; maxillary reaching front of pupil, $2\frac{2}{3}$ in head; upper jaw with a narrow band of villiform teeth, outside of which are a few stronger teeth or canines; anterior canines moderate, about one-fifth eye. Lower jaw with a band of villiform teeth, outside which is a series of canines, six on each side, the lateral canines largest, but smaller than upper front teeth. Tongue toothless. Vomer with a Λ-shaped band, without backward prolongation on median line. Gill-rakers rather short and slender, ten of them developed, not quite one-third of eye. Eye large, 4 in head; nostrils small, well separated, the anterior circular, the posterior oblong. Preopercle strongly serrate below, finely serrate above; above the angle a sharp deep narrow notch, into which a knob of the interopercle fits, as in other species of the group called *Genyoroge* or *Diacope*.

Scales rather small, the rows below the lateral line in nearly horizontal series, those above in very oblique series, nowhere parallel with the lateral line; seven or eight rows of scales on cheeks; those of anterior row largest; one row on interopercle; none on suborbital or preorbital; some scales close to posterior margin of eye. Top of head covered with small scales as far forward as a point opposite front of pupil; about ten rows of scales, large and small, between eye and suprascapula. Soft dorsal and anal scaly. Tubes of lateral line finely branched. Dorsal spines low, moderately strong, the general outline of the fin rounded, a little depressed over last spine. Fourth spine longest, 3 in head. Soft dorsal evenly rounded, quite low, the longest ray $4\frac{1}{5}$ in head. Caudal lunate, the lobes subequal, $1\frac{2}{5}$ times length of middle rays, and $1\frac{3}{5}$ in head. Anal moderate, the free edge of the soft part nearly straight. Second spine longest and strongest, $2\frac{2}{3}$ in head; soft rays $3\frac{1}{4}$ in head. Pectoral long, pointed, $1\frac{1}{5}$ in head, reaching just past vent Ventrals $1\frac{4}{5}$ in head.

Color in spirits brown, apparently golden in life, with five sky-blue longitudinal stripes on side, each of these broadly and sharply margined with dark blue. The whole band is about as broad anteriorly as the interspaces; posteriorly $\frac{2}{3}$ interspace; the dark blue border is nearly as wide on each side as the median pale blue band. These bands are arranged precisely as in *Lutjanus kasmira* (*bengalensis* Bloch), but on the head they are better defined in *L. viridis*, and in *L. kasmira*, the lower band is absent, leaving but four. In *L. viridis* there is a faint median blue streak from occiput on dorsal line to front of dorsal; then a band (of 3 blue streaks as above stated) from occiput above eye to base of 9th dorsal spine; second band from upper edge of eye to middle of soft dorsal; third, from middle of eye to last ray of dorsal; fourth, from canine of upper jaw along lower edge of eye to middle of base of caudal peduncle where it disappears abruptly; fifth, from end of maxillary across lower base of pectoral to above last ray of anal. Fins all

pale; the last spines and first soft rays of dorsal edged with black. No trace of black lateral spot.

This species is closely related to *Lutjanus kasmira* Forskål = *Lutjanus bengalensis* (Bloch) Bleeker, a common species of the East Indian seas. A specimen of the latter, 10 inches long (from Swatow, China Adèle M. Fielde, collector) differs in the following respects: Body deeper (depth $2\frac{2}{3}$); scales smaller (8) 12–62–22; the back more elevated and the profile steeper; snout, 3 in head; preorbital 6; maxillary, $2\frac{3}{5}$. Second anal spine $3\frac{1}{5}$.

In *L. kasmira* the lower lateral band is wanting, and there is a vague, dark lateral blotch larger than eye on the side. The bands in *L. kasmira* are less sharply defined, the blue center of each is more than twice as wide as the dark border, and the whole band is narrower, its width one-third to one-fourth that of the golden-brown interspaces. There is no blue median dorsal streak. In other respects the two species agree closely.

17. Heros beani, sp. nov. 37145 (5), 37165 (2). From Rio Presidio, Mazatlan.

Head, 3 in length; depth, $2\frac{1}{7}$; D XVI, 11, A. V, 8. Scales, $4\frac{1}{2}$–30–12. Length of largest specimen, $5\frac{1}{2}$ inches. Body oblong, compressed, the back moderately elevated; profile gibbous at the nape, depressed and concave above eyes, thence straight to tip of snout, which is short and rather sharp; snout, 3 in head; eye small, $4\frac{1}{2}$ in head, $1\frac{1}{3}$ in the slightly concave interorbital space. Lower lip moderate, its fold continuous, without frenum. Teeth moderate, maxillary short, $3\frac{1}{3}$ in head; lower jaw slightly projecting; preorbital, $4\frac{1}{2}$ in head; 6 rows of scales on cheeks; edge of preopercle oblique, straight, entire; gill-rakers very short, thickish. Dorsal spines low, the longest a little shorter than snout, soft dorsal and anal elevated, pointed, their tips reaching a little past base of caudal, the longest ray about $1\frac{1}{3}$ in head; bases of soft dorsal and anal somewhat scaly; caudal subtruncate. Ventrals reaching beyond pectorals, $1\frac{1}{3}$ in head; pectorals, $1\frac{1}{3}$. Color olive, the centers of many scales on sides of body and head paler in some specimens (♀ ?), and darker in others (♂ ?); sides with traces of about 8 obscure dark cross bars, which are about as wide as the interspaces. A faint pale streak from below eye to maxillary; an obscure black spot, most distinct in young and rather larger than eye, on lateral line and below 11th and 12th dorsal spines; a similar spot at base of caudal, just above lateral line. Fins olivaceous, the dorsals, caudal, and anal with roundish spots of dark olive. Lower fins dusky.

This species is named for my friend, Dr. Tarleton H. Bean, Ichthyologist, U. S. Fish Commission, in recognition of his researches in American ichthyology.

It seems well separated from all other Mexican species of which I find descriptions. A specimen from Lake Nicaragua, which I suppose to be *H. basilaris* Gill, much resembles *H. beani* in form and in colora-

tion. It has, however, the bands and spots more strongly marked; the snout longer, the scales a little smaller, and, moreover, there are 7 anal spines.

18. **Thalassoma lucasanum** (Gill.). 37154 (3). From Tres Marias Islands. These specimens are larger than Gill's types, $3\frac{1}{2}$ inches long.

A broad black band along side, its lower edge passing along lower edge of eye and upper edge of pectoral; then along middle of body curving upward to base of upper lobe of caudal; belly below this abruptly paler, brownish posteriorly; a faint brown streak along sides from behind pectoral to middle of caudal base. Dark lateral band fading insensibly above into the brown hue of the back; upper part of back again black; head all dark, black above, the color gradually fading below to brown. Two pale bluish streaks from lower part of eye downward and backward; a black spot at upper base of pectoral. Dorsal black, with a narrow pale margin on the soft part; caudal pale, its upper and lower rays abruptly black, and narrowly edged with pale. Anal brown at base, pale at tip. Pectoral brown, with a blackish area toward the tip.

Depth of body equal to length of head, four times in length of body to base of caudal. Head rather pointed; dorsal spines pungent; ventrals not filamentous. Scales before dorsal small, 6 in number. Caudal lunate in adult, truncate in the young, the black outer rays produced somewhat beyond the others.

19. **Gobius soporator** Cuv. & Val. 37155 (10). Tres Marias Islands.

20. **Eleotris æquidens** (Jordan & Gilbert). 37142. From Rio Presidio.

21. **Philypnus lateralis** Gill. 27149. (3). From Rio Presidio.

22. **Dormitator maculatus** (Bloch). 37143. From Rio Presidio.

This specimen agrees as well with the description of *D. maculatus* (Atlantic form) as with that of *D. latifrons* (Pacific form) as these are given by Eigenmann & Fordice (Proc. Acad. Nat. Sci. Phila., 1885, 71.) It also agrees with the description of Rio Grande specimens given by Eigenmann & Eigenmann (Proc. Cal. Acad. Sci. 1887, 53.) If more than one species of *Dormitator* exists in tropical North America, the boundaries of the different forms are yet to be shown.

23. **Labrisomus delalandi** (Cuv. & Val.). 37159. From Tres Marias. (*Clinus zonifer* Jordan & Gilbert, 1881.)

This species agrees very well with the published description of *L. delalandi*. I therefore regard *L. zonifer* as a synonym of the latter, which is a Brazilian species. D. IV, XVI, 11. A. II, 18. Scales 55. Head $3\frac{1}{2}$ in length; depth $3\frac{1}{2}$.

24. **Rupiscartes atlanticus** (Cuv. & Val.). 37152 (2). From Tres Marias.

Some specimens apparently males, with the anterior profile vertical and very high; fins high; caudal lanceolate, the black median rays much

exceeding the outer pale ones. Female specimens with the anterior profile a nearly even curve, the caudal lunate, its median black rays shorter than the outer pale ones. Color dark brown, with usually 5 or 6 darker cross-bars extending on the dorsal; a black spot behind eye in all. Dorsal, anal, lower part of pectoral, and middle of caudal black in all.

25. **Balistes capistratus** Shaw. 37156. Tres Marias Islands.

THE INDIANA UNIVERSITY, *December* 6, 1888.

NOTES ON A COLLECTION OF MYRIAPODA FROM CUBA.

BY CHARLES H. BOLLMAN.

This paper is based on a small but interesting collection of myriapods that I have received from Prof. Felipe Poey, of Havana, Cuba.

As Professor Poey did not mention any particular locality in the island of Cuba, I suppose that most of the species are from the vicinity of Havana.

I desire to tender my thanks to Professor Poey for the material I have received from his hands, and to Dr. Juan Gundlach for a specimen of a *Sentigera*.

The types of the new species have been deposited in the U. S. National Museum.

1. Siphonophora portoricensis Brandt.

Siphonophora portoricensis Brandt, Bull. Acad. St. Petersb., 1836 (*name only, teste Gervais*); Brandt, Recueil, 50, 1841 (*name only, teste Gervais*); Koch, Syst. Myr., 143, 1847 (*name only*); Gervais, Apteres, 209, 1847 (*name only*); Peters, Monatsber. kön. preuss. Akad. Wiss. Berlin, 549, 1864 (*first description*); Karsch, Ann. Soc. Ent. Belgique, 166, 1884.

Siphonophora cubana Karsch, Mittheil, Münch. Ent. Ver., 144, 1880; Borre, Am. Soc. Ent. Belgique, 81, 1884.

I have received from Professor Poey a dried *Siphonophora*, which I have been unable to separate from either *Siph. portoricensis* Brandt, or *Siph. cubana* Karsch.

Concerning the differences between these two species, Karsch, under his description of *Siph. cubana*, says:

"*An eadem species cum Siph. portoricensis* Br., *qua tamen capite basi latiore, rostro multo breviore et præcipuæ longitudine multo minore natis differre videtur?*"

As such differences are practically valueless it is best to consider *Siph. portoricensis* and *cubana* as forming one species.

2. Nannole cubensis, sp. nov.

Diagnosis.—Related to *Nannole burkei* Bollman but the circular depressions along the transverse segmental sutures not extending all around the segment as in *burkei*, but only to the repugnatorial pore.

The following differences are also worthy of note:

Dark brownish-blue, posterior border of segments brown, an indistinct row of lateral spots, antennæ and legs light-brown. Ocelli distinct, about 16, arranged in 3 transverse series. Segments 47. Antennæ and legs stouter.

The above notes are based on a dried female, which was afterwards soaked in alcohol. As this is the first record of a species of this genus from Cuba, I have given it the specific name of *cubensis*.

3. **Paradesmus poeyi** Bollman. *Strongylasoma poeyi* Bollman, Ent. Amer., 82, 1887 (*Cuba*).

Abundant.

Through a misunderstanding of the description of *Paradesmus* I placed this species in *Strongylasoma*, and did not discover my mistake until after the description of the above species had been published.

This species should now be placed in the genus *Paradesmus*. It is very closely related to, if not identical with *P. vicarius* Karsch, from Mayotti and Anjaani.

The copulation foot of the males of *poeyi* differs from that of *vicarius*, as figured by Karsch, in having the femoral part twice as long as the tibial, and the lower lobe of the tibial part is wide and thin, with a distinct median thickening, not cylindrical as in *vicarius*.

4. **Leptodesmus couloni.** *Polydesmus* (*Oxyurus*) *couloni* Humbert & Saussure, Myrnora amer., 3, 1869 (*Cuba*).

Among the material sent by Poey is a dried female, which agrees perfectly with the descriptions of the above species.

5. **Stenonia maculata**, sp. nov.

Diagnosis.—Related to *Stenonia fimbriatus* (Peters), but at once separated by the tuberculation of the dorsal plates, by the crenulation of lateral carinæ, by the character of anal segment and the pattern of coloration.

The following is a careful description of the species. Rosy, especially the tubercles; nearly all the repugnatorial pore bearing segments with a dark blotch on each side above the carinæ; antennæ dark, legs pale. Body wide, convex, not attenuated anteriorly, slightly posteriorly Antennæ short, subclavate. First segment very wide, completely concealing the head as in *fimbriatus;* a row of small scales along the posterior margin; two large median scales; along anterior margin a row of twelve rectangular scales, between the third and fourth from posterior angle a distinct notch, between the others a slight waviness. Other segments with three distinct rows of scales with smaller ones interspersed; lateral carinæ crenulate the first six, the eighth, eleventh and fourteenth, with two crenulations, the rest with three; a distinct median dorsal line. Anal segment with six tubercles along posterior margin; preanal scale obtuse, with two long slender spines.

Length: ♂ 9^{mm}, ♀ 12.5^{mm}; width, ♂ 2.2^{mm}, ♀ 2.8^{mm}.

This new species belongs to the subgenus *Stenonia* (=*Platyrhacus.*)

Among the material sent by Professor Poey is a dried male and female of this species.

6. **Rhacophorus magnus**, sp. nov.

Diagnosis.—Related to *R. marantus* (Karsch), but with an indistinct row of tubercles along anterior and posterior margins of segments, and a few on lateral carinæ.

Description of species.—Brown, legs light chestnut; robust, wide and depressed, slightly attenuated anteriorly. Segments with a transverse sulcus as in *marantus*; tubercles indistinct, arranged in a more or less irregular row along the margins, three or four large scales on lateral carinæ; lateral carinæ large, strongly margined, anterior angles rounded, posterior much produced. Repugnatorial pore large, subapical, marginal. Length of last *fourteen* segments 22.5^{mm}, width of seventh segment 4.3^{mm}.

The type of this species is a mutilated female, of which the head and first six segments are lost. On account of this I have been unable to determine the subgenus unless it belongs to the same as *marantus*. Karsch has described two other species of this genus from Cuba, but both belong to the subgenus *Cryptodesmus* and lack the transverse dorsal sulcus. This is the largest *Rhacophorus* known.

7. **Orphnacus brasiliensis** Meinert.

The collection contains a fine female, which agrees very well with Dr. Meinert's description of this species. This is the first record of this species from the West Indies.

8. **Mecistocephalus punctifrons** Newport.

There are a few specimens in the collection which I refer to this species, agreeing with Dr. Meinert in considering *M. guildingii* a doubtful species and identical with *M. punctifrons*.

9. **Scotopendra alternans** Leach.

One female of this species sent by Professor Poey.

10. **Newportia longitarsis** Newport.

Scolopocryptops longitarsis Newport, Linn. Trans., 407, pl. 40, fig. 10, 1844 (*St. Vincent*).

Newportia longitarsis Gervais, Apteres, iv, 298, 1847; Newport, Cat. Myr. Brit. Mus., 57, 1856.

Rufous, head and posterior border of segments darkest, antennæ and legs pale. Moderately robust, smooth, sparsely punctate. Head suboval, sparsely punctate and pilose, not margined, posterior half with two longitudinal sulci. Antennæ short, attenuate, 17 jointed, basal joints crassate, all except the first two hirsute. Prosternum not prominent, callose, sinuate. Anal legs very long and slender, somewhat depressed, femora armed with about 22 large and small hooked spines which are arranged in four or five series, tibia with two long spines beneath, femora and tibia with numerous hooked hairs on the inside. Penultimate pair of legs with the tibia and first tarsal joint also furnished with numerous hooked hairs.

Dorsal plates with six sulci, the median straight or slightly curved inwards, the others outwards. Posterior pleuræ scabrous; pores numerous, small; terminal spine large and robust. Last ventral plate moderately wide, sides converging, posterior border sinuate. Length 28^{mm}, width 3^{mm}.

 July 5, 1889.

In the collection are two specimens which I refer to this species. Both have lost most of their legs, especially the anal, of which only one remains and even it is in a mutilated condition so that the tarsal joints can not be counted.

11. Scutigera sp. ?

I have received from Poey and Gundlach several specimens of a *Scutigera*, which I have been unable to identify satisfactorily with any of the known species.

INDIANA UNIVERSITY,
Bloomington, Ind., June 1, 1888.

NOTES ON A COLLECTION OF MYRIAPODA FROM MOSSY CREEK, TENN., WITH A DESCRIPTION OF A NEW SPECIES.

BY CHARLES H. BOLLMAN.

The following list of myriapods is based upon an extensive collection made at various times by Mr. Charles B. Branner, of Mossy Creek, Tenn. As the material was collected in all seasons of the year, and a large number of species found, it is safe to say that this list is almost complete.

Notes on a small collection made at Mossy Creek and other places in East Tennessee by Dr. John C. Branner were published in the Ann. N. Y. Acad. Nat. Sci. for 1887; but in this list there are no species mentioned as occurring at Mossy Creek which have not been found by Mr. Charles B. Branner.

I here desire to express my sincere thanks to Mr. Charles B. Branner for the numerous specimens he has so kindly sent me.

1. **Andrognathus corticarius** Cope.

Common. The number of segments vary from 55–65 in the adult specimens. The fifth and sixth antennal joints are not united as Cope has stated, but are distinctly separate, the sixth being the largest joint.

2. **Nemasoma minutum** (Brandt).

In one lot of material sent were six specimens of this species.

3. **Parajulus pennsylvanicum** (Brandt).

Abundant.

4. **Cambala annulata** (Say).

Abundant. All the specimens of this species which I have received from East Tennessee and North Carolina (Balsam and Chapel Hill) are very large ($45–52^{mm}$), and of a very dark brown-shade, while those which I have examined from other localities (Indiana and Arkansas) are much smaller ($26–38^{mm}$) and of a light yellowish-brown shade. Specimens from the latter localities may represent a geographical species, but it is hard to say what form Say described, although his description may apply to the former, as his specimens were from Georgia and Florida.

5. **Lysiopetalum lactarium** (Say).

Very common.

6. **Striaria granulosa** Bollman.

One female of this species was found in the collection.

This specimen is curled in the same manner on the type specimen, and no more important characters can be ascertained until one of the specimens is torn to pieces.

7. **Campodes flavicornis** Koch.

This seems to be a rare species in this locality.

8. **Fontaria evides** Bollman.

No others besides the two type specimens of this species were found.

9. **Fontaria tennesseensis**, sp. nov.

Diagnosis.—Related to *Fontaria castanea* (McNeill), but the lateral carinæ larger, and the copulation foot of male different.

Type.—U. S. Nat. Museum; No. 203, Mus. Ind. Univ.; No. 388, author's coll.

Description.—Brown, lateral carinæ pink; an indistinct dark median dorsal line; legs and underparts yellow. Body depressed; anterior segments of female noticeably attenuated; segments smooth, marked with numerous short lines; papillæ prominent, especially on lateral carinæ. Vertex sulcus moderate; occipital, antennal, and clypeal foreolæ single. Lateral carinæ large, moderately produced; repugnatorial pores large and placed on the upper edge of the posterior third of the carinæ. Ventral plates produced into a short straight cone; coxæ unarmed. Male: Segments more depressed than in the female, antennæ more crassate. Copulation foot deeply bifid; the inner or shorter branch cylindrical, tapering, twisted at base; outer or semenal branch somewhat flattened and wavy, end slightly expanded. Length 23–27^{mm}, width 5–7^{mm}.

Tennesseensis is very closely related to *castanea* in all points except the copulation foot and lateral carinæ. From *oblonga* it is separated by not having the posterior border of segments red (white, acc. to Koch, but this is probably due to immersion in alcohol). No. 388 contains five specimens, two males and three females, of which two have been deposited in the U. S. National Museum. No. 203, Mus. Ind. Univ., contains a female of this species.

10. **Euryurus erythropygus** (Brandt.).

Common.

11. **Scytonotus setiger** (Wood).

There are ten specimens of this species in the collection.

12. **Polydesmus branneri** Bollman.

Not common.

13. **Linotænia ruber** Bollman.

Not common.

14. **Linotænia bidens** (Wood).

One specimen of this species obtained.

15. Linotænia robusta (Meinert).

Common.

16. Linotænia fulva (Sæger).

Strigamia fulva Sæger, Proc. Phila. Acad. Nat. Sci., 1856.
Strigamia bothriopa Wood, Journ. Phila. Acad. Nat. Sci., 1861.

Not common.

17. Scolioplanes gracilis Bollman.

Although this species belongs to a new genus, I do not care here to erect a genus for its reception. I prefer to wait until I can obtain more specimens in order to satisfactorily make an examination of the mouth parts.

18. Geophilus varians McNeill.

One specimen, ♀, pairs of legs 57.

19. Geophilus umbraticus (McNeill).

Abundant.

20. Scolopocryptops sexspinosus (Say).

Common.

21. Scolopocryptops nigridius McNeill.

Common.

22. Theatops posticus (Say).

Not common.

23. Theatops spinicaudus (Wood.)

Common.

24. Cryptops hyalinus (Say).

Abundant.

25. Scolopendra woodi Mimert.

One specimen in the collection.

26. Lithobius proridens Bollman.

Not common.

27. Lithobius trilobus Bollman.

Lithobius similis Bollman, Ann. N. Y. Acad. Nat. Sci., 112, 1887 (*Mossy Cr., Tenn.*).

I now consider *similis* as identical with *trilobus*. Only the type specimen of *similis* was obtained.

28. Lithobius lundi Meinert.

Not common.

29. **Lithobius branneri** Bollman.

Common.

30. **Lithobius cantabrigensis** Meinert.

Rare.

31. **Lithobius juventus** Bollman.

Not common.

32. **Lithobius multidentatus** Newport.

Common. Some of the specimens have the coxæ of the anal legs armed laterally with two spines.

INDIANA UNIVERSITY, *October* 20, 1888.

NOTES UPON SOME MYRIAPODS BELONGING TO THE U. S. NATIONAL MUSEUM.

BY CHARLES H. BOLLMAN.

Through the kindness of Dr. Charles V. Riley, I have received for examination the unidentified lot of myriapoda contained in the collection of the U. S. National Museum.

This lot contains both foreign and domestic species, but in this paper I have only given notes upon the forms found in the United States.

In addition, I have included several notes upon some material sent to me by Prof. L. M. Underwood, of Syracuse, N. Y.

These specimens originally belonged to a collection, the remainder of which he had presented to the Museum, and has been sent to me among the material received from Dr. Riley.

I desire to tender my thanks to Dr. C. V. Riley, Mr. J. B. Smith, and to Prof. L. M. Underwood for various favors.

1. **Polyzonium rosalbum** (Cope). Marquette, Mich. E. A. Schwarz.

This specimen, a female, differs from any I have seen in having the general coloration more intensified. Dorsal plates reddish-brown, paler posteriorly and along margins; antennæ almost black; face and legs mottled with a purplish shade.

2. **Platydesmus lecontii** (Wood). Acc. 19542, 9, Tallulah, Ga.; L. M. Underwood. Segments 39–49.

3. **Spirobolus hebes** (Bollman). Acc. 14530, San Diego, Cal. Segments 47, ♀.

4. **Spirobolus marginatus** (Say). (?) Virginia, Kuehling. Acc. 19542, 13, Tallulah, Ga.; L. M. Underwood. Acc. 19542, 12, Macon, Ga.; L. M. Underwood. Segments of males 53–55, segments of females 52–57.

5. **Spirobolus spinigerus** (Wood). Acc. 19343, Cape Romano, Fla.; F. B. Meek. Segments of female, 47–49.

6. **Spirostrepus montezumæ** (Saussure). El Paso, Tex.; Potts.

The specimen before me seems to agree in all respects with the descriptions of *S. montezumæ*, which has only been found in the provinces of Vera Cruz and Orizoba, Mexico. This is the first record of any species of this genus from the United States.

7. **Parajulus canadensis** (Newport). Luray, Va.; L. M. Underwood.

These specimens agree in all respects with the females of *canadensis*, but a male might show some secondary sexual differences. Segments 48–53. Last segment only completely mucronate in about half the specimens.

8. **Parajulus venustus** (Wood). West Cliffe, Colo.; T. D. A. Cockerell.

9. **Parajulus impressus** (Say). Acc. 19542, 7, Tallulah, Ga.; L. M. Underwood. Acc. 19542, 17, Indian Springs, Ga.; L. M. Underwood. Segments 55.

10. **Parajulus pennsylvanicus** (Brandt). Luray, Va.; L. M. Underwood. Acc. 19542, 8, Macon, Ga.; L. M. Underwood.

11. **Lysiopetalum lactarium** (Say). Acc. 19542, 16, Indian Springs, Ga.; L. M. Underwood.

12. **Campodes flavicornis** (Koch). Washington, D. C.; J. B. Smith.

13. **Leptodesmus varius** (McNeill). Macon, Ga.; L. M. Underwood.

I have received from Professor Underwood a young female which agrees in all essential points with the types of *varius* from Pensacola, Fla.

14. **Fontaria crassicutis** (Wood). Acc. 19542, 2, Indian Springs, Ga.; L. M. Underwood. ♂.

Ventral plate and coxæ unarmed; that part of ventral plate which lies between the two pairs of legs of 11–16th segments produced into a conical lobe; legs densely but shortly pilose; color brown, lateral carinæ and under parts yellow; length 70^{mm}, width 15^{mm}.

15. **Fontaria georgiana**, sp. nov.

Diagnosis.—Probably related to *F. virginiensis*, but the ventral plates and coxæ sharply spined; the upper branch of genitalia bifid.

Habitat.—Lookout Mountain, Tallulah and Macon, Ga.; L. M. Underwood.

Type.—Acc's. 19542, 4, 6, 10, 11, 20; U. S. Nat. Museum.

Description.—Dull brown, lateral carinæ; a median dorsal row of spots and underparts yellow. Segments considerably wrinkled. Vertex sulcus shallow, occipital foveolæ 2+2, antennel and clypeal single. Lateral carinæ large, interlocking, posterior angles scarcely produced. Repugnatorial pore large, placed on the upper side of margin near the middle. Ventral spines sharp; coxæ spined. ♂; Segments more depressed than in the female, and antennæ more crassate. Coxæ of copulation foot pilose and armed above with a large straight spine, as in *F. virginiensis.* Distal halves of copulation foot curving away from each other, but the ends come together and interlock; bifid, the lower branch cylindrical, tapering and slightly curved upwards, the upper branch bifid, the seminal branch of which is flattened, the other is a cylindrical hooked spine. Length, $28–35^{mm}$.

This species shows relationship to *F. virginiensis* by the coxæ of copulation foot being provided with a long, straight spine. It also agrees with the more eastern specimens of *F. virginiensis* by having the ventral plates and coxæ spined. *F. georgiana* is described from numerous specimens from Macon, a few from Tallulah, and one from Lookout Mountain.

16. **Fontaria tallulah** sp. nov.

Diagnosis.—Ventral plates and coxæ spined as in *F. georgiana*, but separated from that species by having the lateral carinæ and posterior margin of dorsal plates red; posterior angle of lateral carinæ rather sharply produced.

Habitat.—Tallulah, Ga.; L. M. Underwood.

Type.—Acc. 19542, 20; U. S. Nat. Museum.

Description.—Brownish black, lateral carinæ and posterior border of each segment red; antennæ, legs, and underparts yellow. Segments depressed, anterior segment moderately attenuated; corrugated, especially posteriorly and on lateral carinæ; papillæ distinct; vertex sulcus distinct; occipital foveolæ 2+2, antennal and clypeal single (1+1). Lateral carinæ large, interlocking posterior angle rather sharply produced. Repugnatorial pores large, placed on the upper margin of posterior third. Ventral spines straight, stout, and conical, coxæ armed. Length, 25^{mm}.

F. tallulah seems to be only related to *F. georgiana* by having the ventral plates and coxæ spined. In the pattern of coloration it approaches *F. rubromarginata*, but that species has the ventral plates unarmed and, therefore belongs to the same section as *F. corrugata evides*, etc. This species is described from an apparently adult female.

17. Fontaria rileyi, sp. nov.

Diagnosis.—Brown, lateral carinæ red; ventral plate and coxæ unarmed; copulation foot stout, flattened, end subsimilar to a bird's head.

Type.—Acc. 19542, 5, U. S. Nat. Museum.

Habitat.—Macon, Ga.; L. M. Underwood, ♂.

Description.—Brown, lateral carinæ red; antennæ, legs, and under parts yellow. Segments moderately depressed, scarcely attenuated anteriorly; very corrugated, papillæ not prominent; behind each pore an indistinct black swelling. Vertex sulcus shallow; occipital, antennal, and clypeal foveolæ single. Lateral carinæ large, interlocking, posterior angle not much produced. Repugnatorial pores large, placed on the posterior third of margin. Ventral plate unarmed; coxæ not or very slightly armed; femora strongly armed; claws normal. Male: Copulation foot stout, flattened, curved, end subsimilar to a bird's head. Length, 43.5^{mm}; width, 10.2^{mm}.

This species belongs to the same group as *F. carrugata*, *evides*, etc., and should stand near the latter, as shown by the form of the copulation foot. It is separated from *F. evides* by having the copulation foot more flattened, especially the end, which is cylindrical in *evides;* besides *F. rileyi* attains a larger size.

This species is described from a male specimen.

I take great pleasure in dedicating this species to Dr. C. V. Riley, United States Entomologist, to whom I am indebted for numerous favors.

18. Euryurus erythropygus australis, sub. sp. nov.

Diagnosis.—Similar to *E. erythropygus*, but the lateral carinæ larger, the margin less swollen, more straight, and the denticules larger. Upper branch of copulation foot five times as long as the lower. Body slenderer.

Type.—Acc. 19542, 18, Indian Springs, Ga.; L. M. Underwood, ♂.

When compared with *E. erythropygus* this new geographical species plainly differs from it by the characters given. The lateral margin of carinæ are also slightly crenulate and the anterior is somewhat serrate. Length, 28^{mm}; width, 3.4^{mm}.

The exceedingly long branch of the copulation foot at once separates *australis* from the true *erythropygus*. The inner tooth is also absent, but this is subject to slight variations in *erythropygus*.

The above notes are taken from a male which is slightly broken.

19. **Polydesmus branneri** Bollman. Acc. 19542, 23, Tallulah, Ga.; L. M. Underwood.

These specimens are all females, and I refer them to this species with some doubt, but as they are from the region in which *P. branneri* is found they must belong to that species and not to *P. serratus*, which is not quite so southern in its range.

20. **Polydesmus serratus** Say. Marksville and Natural Bridge, Va.; L. M. Underwood.

21. **Linotænia chionophila** Wood. ? No. 89, U. S. Nat. Mus. Washington, D. C.; J. B. Smith.

Pairs of legs of female 37–41.

22. **Linotænia fulva** Saeger. Acc. 19542, 15, Indian Springs, Ga.; L. M. Underwood.

Pairs of legs of male 51.

23. **Linotænia parriceps** Wood. Acc. 17414, Baird, Shasta County, Cal.; L. M. Green.

Pairs of legs of male 79.

24. **Geophilus foveatus** McNeill. Lookout Mountain; L. M. Underwood.

Pairs of legs of female 43; pleural pores less numerous than in the northern specimens.

25. **Geophilus umbraticus** McNeill. West Cliffe, Colo.; T. D. A. Cocherell.

Pairs of legs of female 49–51.

26. **Geophilus virginiensis**, sp. nov.

Diagnosis.—Related to *G. mordax*, but on the anterior ventral plates, especially the 7–13th, an ovate depressed poriferous area along the anterior margin, into which projects a conical elongation of the preceding segment; coxæ of prehensorial legs of about equal length and breadth.

Habitat.—Natural Bridge, Va.; L. U. Underwood.

Type.—U. S. Nat. Museum.

As is indicated by the above diagnosis this new species is closely related to *G. mordax*.

My specimen is a male, and as *G. mordax* is described from a female, the following secondary differences are worthy of notice:

Anal legs moderately crassate, densely and shorty pilose; claw large; pairs of legs 49; length 35^{mm}.

If the characters given in the diagnosis are those peculiar to a male, this new species must be identical with *mordax*, but the proportions of

the coxæ of prehensorial legs seem to convince me that they are not markings peculiar to a male.

27. **Geophilus smithi**, sp. nov.

Diagnosis.—Related to *G. huronicus*, but the coxal pores more numerous, 25–30; coxæ of prehensorial legs of about equal length and width; pairs of legs of female 49; length 20–28^{mm}.

Habitat.—Washington, D. C.; J. B. Smith.

Type.—U. S. Nat. Museum.

This species is very closely related to *G. huronicus*, but it seems to be sufficiently distinct as shown by the number of coxal pores, which are 25–30 in number in *smithi*, but only 7 or 8 in *huronicus;* also by the number of pairs of legs (*huronicus*, ♂ 53–55, ♀ 55–57).

This species is described from two females, one of which is an adult, the other being about three-fourths grown.

28. **Geophilus bipuncticeps** Wood. Macon, Ga.; L. M. Underwood.

Pairs of legs, ♂ 55, ♀ 55–59.

29. **Scolopocryptops sexspinosus** Say.

Scolopocryptops georgicus Meinert, Proc. Amer. Phil. Soc., 180, 1886 (*Georgia*).
Acc. 19542, 24, Tallulah, Ga.; L. M. Underwood. Acc. 19542, 14, Indian Springs, Ga.; L. M. Underwood. Luray, Va.; L. M. Underwood.

The specimens contained in the first two vials seem to belong to that phase of *S. sexspinosus* which has been described by Meinert under the name of *S. georgicus*. The only real tangible difference I can find between these specimens and the true *sexspinosus* is in the moderately toothed condition of the prosternum, and I think it is best to consider *georgicus* as not a valid species.

30. **Theatops posticus** Say. Acc. 19542, 3, Macon, Ga.; L. M. Underwood. Luray and Natural Bridge, Va.; L. M. Underwood.

31. **Cryptops hyalinus** Say. Natural Bridge, Va., and Lookout Mountain; L. M. Underwood.

Serratures of anal legs 6–2.

32. **Scolopendra woodi** Meinert. Acc. 19542, 1, Indian Springs, Ga.; L. M. Underwood.

33. **Scolopendra heros** Girard. Florida, F. B. Meek, Fort Reynolds; A. Clough.

34. **Scolopendra pachypus** Kohlrausch. Acc. 4631, San Diego, Cal.

As shown by the character of the anal legs this species seems to be sufficiently distinct from *heros*.

35. **Lithobius proridens** Bollman. Washington, D. C.; J. B. Smith. One specimen.

36. **Lithobius obesus** Stuxberg. No. 73*a*, U. S. N. M., Salt Lake City, Utah.

In this vial along with a few hexopods I found a male *Lithobius*, which I provisionally refer to this species.

As this is a male, the following differences are worthy of notice:

Antennæ 22 jointed; coxal pores 2, 3, 4, 3; spines of first pairs of legs 2, 3, 2; of anal pair 1, 3, 2, 0; anal legs of male moderately cras-

sate, tibia slightly swollen, excavated on the inner side near the base and the upper interior angle produced into a slight pilose lobe; last tarsal joints of legs more densely pilose beneath than the rest.

In the character of the anal legs this specimen agrees with *paradoxus;* but that species has the number of coxal pores and the spines of the anal legs less.

37. Lithobius elattus, sp. nov.

Diagnosis.—Related to *L. pullus*, but spines of anal legs 1, 3, 2, 0, or 1, 3, 1, 0; joints of antennæ 20–22; tarsal lobe of anal legs of male larger; size smaller than *L. pullus.*

Habitat.—Washington, D. C. (J. B. Smith); Marksville, Va. (L. M. Underwood).

Type.—U. S. Nat. Museum.

Description.—Light brown, head and antennæ darker; tip of antennæ rufous. Moderately robust, smooth, sparsely pilose; head of about equal length and breadth. Antennæ moderate, articles 20–22. Ocelli 8–10, arranged in 3–4 series. Prosternal teeth 2+2. Coxal pores 2, 3, 3, 2–3, 4, 4, 3, round. Spines of first pair of legs 1, 2, 1; of penultimate pair 1, 3, 3, 2; of anal pair 1, 3, 2, 0–1, 3, 1, 0.

Male: Anal legs more crassate; first tarsæ of anal legs prolonged into a pilose lobe at its upper interior angle. Female: Claw tripartite, short and wide; spines 2+2, short and stout, end flattened and barely serrate. Length 8–9.5^{mm}.

This species is described from four specimens, three females and one male from Washington, D. C., and a male from Marksville, Va.

Although the above descriptions hardly seem to do justice in separating this new species from *L. pullus*, yet, when we place the two species side by side, they can not be mistaken, as the size of *pullus* is always 2–4^{mm} larger.

Time may prove that this new species is only an eastern variety of *L. pullus*, but until intermediate specimens are found it is best to consider them as distinct species.

38. Lithobius kochi Stuxberg. West Cliffe, Colo.; T. D. A. Cockerell.

Anal legs armed with two claws. Coxal pores few in a single series. Penultimate pair of legs armed with two claws. Coxal of last two pairs of legs laterally armed. Testaceous brown, antennæ and head darkest, legs paler. Moderately slender, smooth, sparsely pilose; head of about equal length and breadth. Antennæ short, reaching to the fifth segment, articles 20. Ocelli 8 or 9, arranged in 4 series. Prosternal teeth 2+2. Coxal pores 2, 2, 3, 3–3, 3, 3, 3, round. Spines of first pair of legs 1, 1, 1; of penultimate pair 1, 3, 3, 2; of anal pair 1, 3, 2, 0.

Male: Anal legs somewhat stouter than those of female. Female: Claw of genitalia bipartite, short and wide; spines 2+2; inner much shorter. Length 7.–7.8^{mm}.

I at first considered these specimens as representing a new species,

but as the apparent differences gradually dwindled down to the number of spines of the first pair of legs I finally concluded that they were identical with *kochi*, which has only been found at Saucelito, Cal.

For the sake of completeness I have given a description of the specimens.

39. **Littleobius atkinsoni** Bollman. Macon, Ga., L. M. Underwood.

Among the material sent by Dr. Underwood are three specimens, two females and one male that I refer to this species.

The following points are worthy of notice: Antenæ 21–33 articulated; ocelli 8–20, arranged in 4–7 series; prosternal teeth 5+5 or 7+7; coxæ of last three pairs of legs laterally armed; coxal pores 3, 4, 4, 4–6, 7, 7, 6, round or transverse; spines of first pair of legs 1, 2, 1 or 2, 3, 1; spines of anal and penultimate pairs 1, 3, 3, 1; last two tarsal joints of anal and penultimate pairs of legs of male sulcate on the inner side.

40. **Lithobius xenopus**, sp. nov.

Diagnosis.—Related to *L. mordax*, but the femoral and tibial joints of the anal legs of male strongly modified.

Habitat.—Macon, Ga.; L. M. Underwood.

Type.—Acc. 19542, 22 U. S. Nat. Museum

Description.—Brown, head rufous, antennæ dark, legs pale. Moderately slender, rather smooth, sparsely pilose; head wider than long (4:3). Antennæ moderately long, reaching the seventh segment, articles 30, short. Ocelli 32, in 7 transverse series. Prosternal teeth 6+7. Coxal pores 6, 6, 6, 4, round. Spines of first pair of legs 2, 3, 2; of penultimate pair 1, 3, 3, 2; of anal pair 1, 3, 3, 2. Claws of anal and penultimate pairs of legs single. Coxæ of the last three pairs of legs laterally armed.

Male: Anal legs moderately short; femora considerably swollen on the inner side, and armed on the posterior half with two large, slightly curved, bluntly serrated spines; tibia excavated on the inner side, the posterior half produced into a bipartite contorted lobe, of which the posterior is armed with a short, curved, sharply serrated spine. The last two tarsal joints of anal and penultimate pairs of legs sulcate on the inner side. Length 17.5^{mm}.

Although the males of nearly every species of the subgenus *Neolithobius* show some modifications of the anal legs, yet this species presents a curious peculiarity and approaches to that of *L. bilabiatus* in the extent of the modification. The above description is based upon a single male specimen.

41. **Lithobius latzeli** Meinert. Marksville and Luray, Va.; L. M. Underwood.

Antennæ 29–34; coxal pores 5, 6, 5, 4–6, 7, 7, 6; prosternal-teeth 9+9 or 10+10; spines of first pair of legs 2, 3, 2; spines of anal and penultimate pairs 1, 3, 3, 2.

42. **Lithobius underwoodi**, sp. nov.

Diagnosis.—Related to *L. juventus*, but the prosternal teeth 6+7; coxal pores 7, 7, 7, 6, transverse; size much larger.

Habitat.—Macon, Ga.; L. M. Underwood.

Type.—Acc. 19542, 22; U. S. Nat. Museum.

Description.—Dark shining brown, head and antennæ darkest, legs paler. Robust, attenuated posteriorly, moderately smooth; head wider than long (4 : 3). Antennæ long, extending to the tenth segment, articles 32. Ocelli 25, in 6 transverse series. Prosternal teeth 6+7. Coxal pores 7, 7, 7, 6, transverse. Spines of first pair of legs 2, 3, 2; of penultimate and anal pair 1, 3, 3, 2. Anal and penultimate pairs of legs each with two claws. Coxæ of the last three pairs of legs laterally armed.

Female: The last two tarsal joints of anal and penultimate pairs of legs sulcate on the inner side; claw of genitalia large and long, indistinctly tripartite; spines 2+2, stout, inner shortest. Length 20mm.

This species is very different from *L. juventus*, which is the only North American species belonging to the same group, although they may have originally sprung from the same stock. This species is described from a female which has the anal pairs of legs broken off.

43. **Lithobius rex**, sp. nov.

Diagnosis.—Related to *L. validus*, of Europe, but the antennæ 20-jointed.

Habitat.—Tallulah, Ga.; L. M. Underwood.

Type.—Acc. 19542, 21; U. S. Nat. Museum.

Description.—Grayish-brown, head, antennæ, first dorsal plate, and margins of others dark. Robust, attenuated posteriorly, dorsal plates much wrinkled, sparsely pilose; head wider than long (6 : 5). Antennæ long, extending to the ninth segment, articles 20, long. Ocelli 19, in 6 transverse series. Prosternal teeth 9+9. Coxal pores 8, 8, 8, 7, large, transverse. Spines of the first pair of legs 1, 3, 2; of penultimate pair 1, 3, 3, 2; of anal pair 1, 3, 2.

Female: Claw of genitalia wide and short, tripartite; spines 2+2, short and stout, ends flattened and obscurely serrate. Length 25mm.

This species is described from a female specimen, which has the fourth segment considerably angulated, and I at first placed it in a new subgenus. But a study of *multidentatus* showed that the angulation of the fourth dorsal plate was subject to considerable variation.

This is the only North American species of the subgenus *Eulithobius* that has the coxal pores in a single series, and in this respect approaches *L. validus* of Europe; but that species has 40–48 antennal joints. Acc. 19542, 21 contains a female of this species.

44. **Lithobius multidentatus** Newport. Marksville and Natural Bridge, Va.; L. M. Underwood.

INDIANA UNIVERSITY, *December* 1, 1888.

DESCRIPTIONS OF FOURTEEN SPECIES OF FRESH-WATER FISHES COLLECTED BY THE U. S. FISH COMMISSION IN THE SUMMER OF 1888.

BY DAVID STARR JORDAN.

(With Plates XLIII—XLV.)

A large part of the summer of 1888 was spent by the writer in the exploration of the streams of Virginia and North Carolina, under the auspices of the U. S. Fish Commission. In this work I had the efficient assistance of Prof. Oliver P. Jenkins, of De Pauw University, Greencastle, Ind.; Barton W. Evermann, of the State Normal School, Terre Haute, Ind.; and Seth E. Meek, of Coe College, Cedar Rapids, Iowa. The basins of the Shenandoah, James, Roanoke, Kanawha, Holston, French Broad, Catawba, Yadkin, Cape Fear, Neuse, Tar, and Black water Rivers were more or less fully explored, and upwards of 7,000 specimens, mostly of small fishes, were secured.

Among the species obtained fourteen appear to be certainly new to science. Types of each of these species have been sent to the U. S. National Museum. These species are described in advance of the general report by permission of Col. Marshall McDonald, U. S. Commissioner of Fish and Fisheries.

The new species described are the following:

1. *Noturus furiosus* Jordan & Meek.
2. *Noturus gilberti* Jordan & Evermann.
3. *Moxostoma rupiscartes* Jordan & Jenkins.
4. *Notropis* (*Luxilus*) *macdonaldi* Jordan & Jenkins.
5. *Notropis kanawha* Jordan & Jenkins.
6. *Hybopsis watauga* Jordan & Evermann.
7. *Fundulus* (*Xenisma*) *rathbuni* Jordan & Meek.
8. *Chologaster avitus* Jordan & Jenkins.
9. *Etheostoma* (*Percina*) *rex* Jordan & Evermann.
10. *Etheostoma* (*Hadropterus*) *roanoka* Jordan & Jenkins.
11. *Etheostoma* (*Boleosoma*) *podostemone* Jordan & Jenkins.
12. *Etheostoma* (*Ulocentra*) *verecundum* Jordan & Evermann.
13. *Etheostoma* (*Nanostoma*) *swannanoa* Jordan & Evermann.

I have also added (14) a redescription of *Etheostoma longimane*, and (15) a description of a new species from Mexico, *Etheostoma australe*.

1. Noturus furiosus Jordan & Meek, sp. nov. (Type No. 39932, U. S. Nat. Mus.) Closely allied to *Noturus miurus*.

Head, $3\frac{3}{4}$ in length; depth, $5\frac{1}{2}$; width of head, $4\frac{1}{3}$. D. I, 6. A. 14. Length of largest specimen, $3\frac{1}{2}$ inches.

Body moderately elongate, about as in *N. miurus*. Head broad, de-depressed, flat between the eyes. Eyes moderate, $1\frac{1}{2}$ in interorbital

width, $4\frac{1}{3}$ in head. Lower jaw included; band of premaxillary teeth not produced backward. Barbels rather long, the maxillary barbel reaching gill opening. Insertion of dorsal considerably nearer adipose fin than snout, its spine $2\frac{1}{3}$ in head; pectoral spine extremely large; longer, stronger, and more heavily armed than in any other North American Catfish; its length $1\frac{1}{4}$ in head. It is provided with antrorse teeth on its outer margin, these growing larger and less retrorse towards the end of the spine. The tip of the spine is, however, free from teeth on either side. Inner margin of spine with seven or eight strong recurved hooks. Humeral process moderate. Adipose fin high, with a deep notch, which extends almost to its base. Caudal long, its tip rounded; anal short, rather high, its base 6 in body, its longest rays 2 in head. Color more varied than in any other of our Catfishes; the pattern similar to that of *N. miurus*. Light brown; entire upper parts and fins punctate with black dots; a dusky area between eyes; a black saddle-like blotch across occiput; a large one before and one behind dorsal and one on adipose fin; a crescent-shaped bar at base of caudal; three distinct black curved streaks across caudal, and two across soft dorsal and anal; these markings less distinct in the young.

This species is the most strongly armed of the North American Catfishes, and according to Professor Jenkins the poison of its axillary gland is more virulent than that of other species.

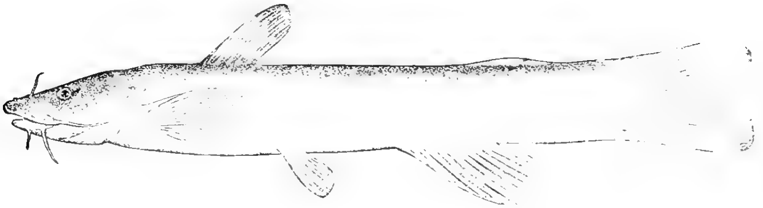
Numerous specimens were taken in the Neuse River at Millburnie, near Raleigh; one in the Little River at Goldsborough, and one in the Tar River at Rocky Mount. Specimens in the U. S. National Museum from Tarborough, N. C. (James W. Milner, collector), were at first identified by me as *Noturus eleutherus* and afterwards as *Noturus miurus.*

2. **Noturus gilberti** Jordan & Evermann, sp. nov. (Type, No. 39931, U. S. Nat. Mus.) From Roanoke, Va.

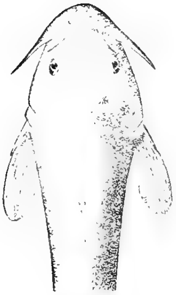
Head, $4\frac{4}{5}$ in length; depth, 7; width of head, $5\frac{2}{3}$. D. I, 6. A. 15. Length, $3\frac{1}{2}$ to 4 inches.

Body slender, moderately compressed; the body less compressed, the head narrower and less depressed than in *N. insignis*, the snout less obtuse. Eyes quite small, 2 to $2\frac{1}{2}$ in interorbital width, about 5 in head. Band of premaxillary teeth without backward processes. Lower jaw decidedly shorter than upper, the difference about the diameter of the eye; maxillary barbels short, dark, not reaching nearly to the gill opening.

Origin of dorsal fin considerably nearer to the snout than to the adipose fin, its spine scarcely longer than eye, about 5 in head. Pectoral spine extremely short, stoutish, its inner margin with sharp teeth on the basal part, its outer margin nearly entire, roughish toward the tip. Adipose fin very low, separated from the caudal by a broad shallow notch, which extends almost or quite to the base of the fin. The adipose fin is as free from the caudal as in *N. eleutherus.* Anal fin short and high, its base $6\frac{1}{2}$ in body, its longest ray $1\frac{1}{2}$ in head. Caudal fin broad,



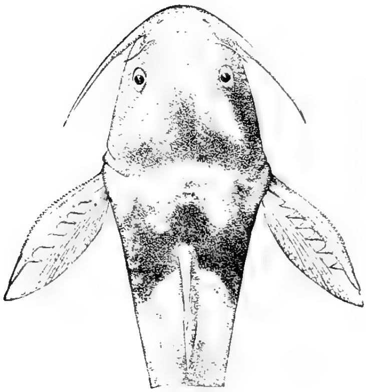
2



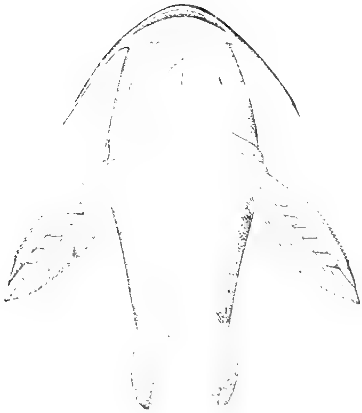
2a

2b

1



1a



1b

FIGS. 1, 1*a*, 1*b*. *Notorus furiosus*, n. sp. (Page 351.)
FIGS. 2, 2*a*, 2*b*. *Notorus gilberti*, n. sp. (Page 352.)

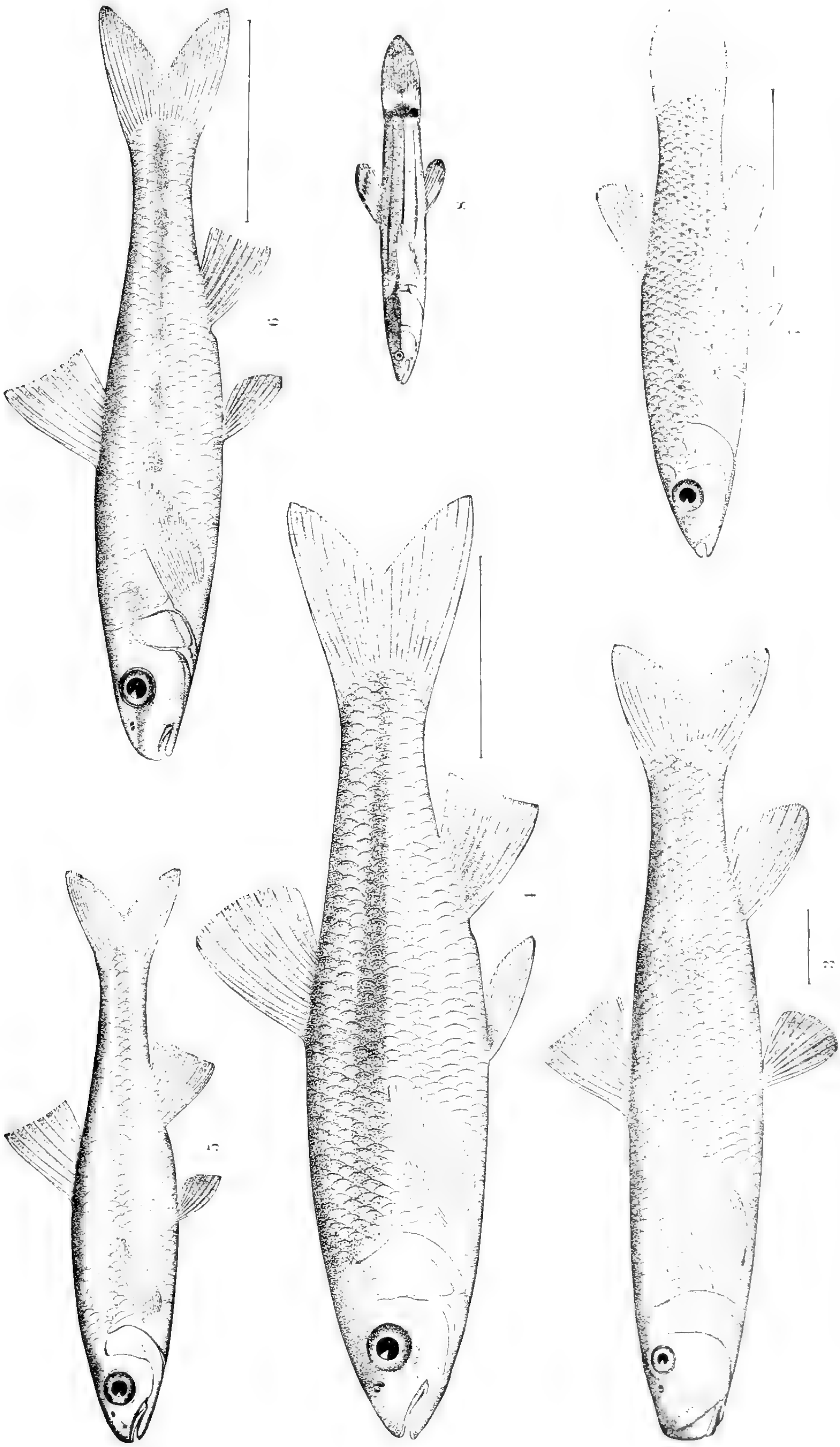


FIG. 3. *Moxostoma rupiscartes*, n. sp. (Page 353.)
FIG. 4. *Notropis macdonaldi*, n. sp. (Page 354.)
FIG. 5. *Notropis kanawha*, n. sp. (Page 354.)

FIG. 6. *Hybopsis watauga*, n. sp. (Page 355.)
FIG. 7. *Fundulus rathbuni*, n. sp. (Page 356.)
FIG. 8. *Cholagaster avitus*, n. sp. (Page 356.)

not rounded, but obliquely truncate, almost emarginate, the lower lobe slightly the longer. Color dark yellowish-brown, finely punctulate above, paler below; base of caudal and most of the lower lobe black; sometimes all black except the tip of the upper lobe; dorsal black at base, pale above.

This species is one of the most distinct in the genus. It is nearest related to *N. exilis*, *N. nocturnus*, and *N. leptacanthus*, but it is well separated from all of these.

Many specimens were obtained in the Roanoke River, at Roanoke, Salem, and Alleghany Springs. It is found in company with the "Mad Tom," *Noturus insignis*. It is less abundant than the latter, however, and reaches a smaller size.

We have named this species for our friend and colleague Dr. Charles H. Gilbert.

3. **Moxostoma rupiscartes*** Jordan & Jenkins, sp. nov. (Type No. 39927, U. S. Nat. Mus.)

Closely allied to *Moxostoma cervinum*, differing chiefly in its smaller scales and more uniform coloration. It reaches a larger size; its lips are larger, and the form of its dorsal fin is some what different.

Head, $4\frac{4}{5}$ in length; depth, $5\frac{1}{2}$ to 6. D. 11. A. 8. Scales 6–50–6. Length of largest specimen, 11 inches.

Body long and low, slender, subterete anteriorly, compressed behind. Head very short, broad, flat between the eyes. Snout bluntish, projecting beyond mouth; its length $2\frac{1}{3}$ in head. Eye moderate, $4\frac{1}{2}$ in head; interorbital width $2\frac{1}{2}$ in head. Lips full, the lower truncate behind, plicate in young, the folds in adult so broken as to form coarse papillæ; scales small, a little smaller anteriorly, 18 before dorsal (scales 43 in *M. cervinum*, 15 before dorsal). Dorsal fin low and small, its free edge concave, the first ray slightly produced, $1\frac{1}{2}$ in head. Caudal short, lunate, its lobes equal and bluntish, the upper $1\frac{1}{3}$ in head; pectorals long, $1\frac{1}{10}$ in head; ventrals short, $1\frac{1}{2}$; anal $1\frac{1}{3}$. Air-bladder in three parts.

Color—Adult, dark olive-brown above, paler below, the dark color of back extending irregularly downward, not sharply divided from the paler of belly; fins all dusky. In the adult the pale streaks along the rows of scales are entirely obliterated. Young grayish, becoming gradually paler below; faint pale streaks along the rows of scales; a faint dusky spot above base of pectoral; tips of dorsal and caudal more or less dusky (inky-black in *M. cervinum*).

Many specimens of this species were obtained in the Catawba River at Marion, in Buck's Creek at Pleasant Garden, in John's River near Morganton, in North Carolina; and in Pacollet River at Clifton, and Tiger River at Cleveland Shoals, both these localities being in the

* *Rupiscartes* (a hybrid word), used by Swainson to mean rock-jumper, a species of *Salarias* which jumps on rocks, like a lizard.

July 5, 188

vicinity of Spartanburgh, S. C. About Spartanburgh, this is one of the common food-fishes.

Specimens of *Moxostoma rupiscartes* (identified by me as *M. cervinum*) have been taken by me in the Saluda River at Greenville, S. C., in the Chattahoochee at Gainesville, Ga., and in the Ocmulgee at Flat Shoals, Ga. In the James, Roanoke, Tar, and Neuse Rivers we found the genuine *M. cervinum.*

4. **Notropis macdonaldi** Jordan & Jenkins., sp. nov. (Type No. 39859, U. S. Nat. Mus.)

Subgenus Luxilus Rafinesque, allied to *N. zonatus* (Agassiz), and less closely to *N. megalops* Rafinesque.

Head contained $3\frac{3}{4}$ times in length to base of caudal; depth, $4\frac{3}{4}$. D. 8. A. 9 or 10. Scales, 7–39–2. Length of largest specimen 5 inches.

Form more elongate than that of *N. megalops*, the head longer and more pointed, the form of body and head much as in *N. zonatus*, but the body still more slender. Body elongate, compressed, the back a little elevated; anterior profile gently curved from snout to front of dorsal, a little more convex on snout. Eye moderate, a little shorter than snout; in adult, $4\frac{1}{3}$ in head. Mouth large, terminal, oblique, the lower jaw somewhat projecting; maxillary extending to opposite front of eye, as in *zonatus*, its length $2\frac{7}{8}$ in head. In *N. megalops* of the same size the snout is much more obtuse, and the maxillary is less than one-third of head.

Scales less crowded than in *N. megalops*, the exposed surfaces less narrowed; scales before dorsal small, in 17 to 20 rows. Lateral line decurved. Insertion of dorsal somewhat behind that of ventral, nearer to base of caudal than to snout. Fins moderate; free margin of anal concave; pectoral not quite reaching ventrals, the latter scarcely to vent. Teeth, 2, 4–4, 2, with narrow grinding surface and a hook.

Color in spirits, greenish, with a broad, diffuse lateral band of plumbeous silvery; a dark streak along back; no caudal spot; fins plain. In life the snout and chin are red, as are also the axils of pectorals and ventrals; the space between the rami of the lower jaw retains the orange color in alcohol. The scales of the upper part of the body and head are profusely punctate with black. The boundaries of the scales are not very well defined.

Numerous specimens of this species were obtained from the Shenandoah River at Waynesboro, Va., from North River, at Loch Laird, Va., and from Buffalo Creek, near Lexington, Va. The two streams last mentioned flow into the James below the Natural Bridge.

We have named this species in honor of Col. Marshall McDonald, the efficient head of the U. S. Fish Commission.

5. **Notropis kanawha** Jordan & Jenkins, sp. nov. (Type No. 39928, U. S. Nat. Mus.) Allied to *N. illecebrosus* (Girard).

Head, $4\frac{2}{5}$ in length; depth $4\frac{3}{5}$. D. 8. A. 9. Scales $4\frac{1}{2}$–37–2, 16 scales before dorsal. Teeth 4–4, hooked, with grinding surface. Length of type, $3\frac{1}{2}$ inches.

Body rather elongate, moderately compressed, the back a little elevated. Snout bluntish, not very short, $3\frac{1}{2}$ in head, its profile gently decurved; jaws equal; mouth rather oblique, the maxillary 3 in head, reaching to opposite front of eye; interorbital space flattish, a little broader than eye; eye large, $3\frac{1}{2}$ in head, smaller than in *N. scabriceps*, which this species resembles in many respects. Preorbital broad; first suborbital narrow; scales large; lateral line gently decurved. Fins all rather high; pectorals nearly reaching ventrals. Insertion of dorsal distinctly behind ventrals, midway between nostril and base of caudal.

Color translucent green; sides bright silvery, with few punctulations. No caudal spot.

This species was found to be rather common in Reed Creek, a tributary of the Kanawha, near Wytheville, Va.

6. Hybopsis watauga Jordan & Evermann, sp. nov. (Type No. 39929, U. S. Nat. Mus.)

Allied to *H. dissimilis* (Kirtland), but with smaller scales, the body more slender, the coloration less varied.

Head, $4\frac{1}{3}$ in length; depth, $5\frac{1}{2}$ to 6. D. 7. A. 7. Scales 4–52–4, 20 to 24 before dorsal. Length of type, 4 inches.

Body elongate, subterete, the back little elevated; head rather long and low, flat on top, the anterior profile blunt, decurved. Lips thick; barbel evident; mouth horizontal, wholly inferior, the maxillary reaching to opposite posterior nostril, 4 in head. Snout, $2\frac{3}{4}$ in head. Eye very large, placed high, its diameter $3\frac{1}{4}$ in head, a little less than length of snout; preorbital long and broad. Scales small, those before dorsal and on belly reduced in size; breast naked. Insertion of dorsal before that of ventrals, slightly nearer snout than base of caudal. Pectoral long, $1\frac{1}{6}$ in head; other fins all small. Lower pharyngeals weak; the teeth 4–4, small, short, hooked, with slight grinding surface.

Color olivaceous above, side with a dark bluish lateral stripe not so wide as eye, passing around the snout; on this stripe are eight to twelve rounded blackish spots, diffuse and not so large as eye, one of these at base of caudal; a dark speck on front of opercle; a few dark spots each as large as a scale on back, especially on back of tail. Fins pale.

Comparing this species with *H. dissimilis* we find the scales smaller (40 to 44 in *H. dissimilis*, 18 before dorsal), the body more elongate (depth usually 5 in the latter), and the color less variegated. In most specimens of *H. dissimilis* the back and sides are covered with irregular dark spots, some of the scales being dusky. About six specimens of this species were taken in the north fork of the Holston River at Saltville, Va., and two in the Watauga River at Elizabethtown, Tenn. This species is probably widely diffused, having been hitherto confounded with *H. dissimilis*. The specimens from the White River, Eureka Springs, Ark., scales 49 or 50, should be referred to *H. watauga*. The other specimens of this type accessible to the writer belong to *H. dissimilis*. These represent the following localities: Spring Creek, Hot

Springs, N. C.: Swannanoa River, Asheville, N. C.; White River, Gosport, and Indianapolis, Ind.: Rock River, Ogle County, Ill.; Des Moines River, Ottumwa, Iowa; Saline River, Benton, Ark.; Washita River, Arkadelphia, Ark.

7. **Fundulus rathbuni** Jordan & Meek, sp. nov. (Type No. 39860, U. S. Nat. Mus.)
Subgenus *Xenisma* Jordan, allied to *Fundulus stellifer* Jordan.

Head, 3⅓ in length to base of caudal; depth 4½. D. 11. A. 11. Scales, 38–12. Length, 2½ inches. Body moderately elongate, rather robust, little compressed; the back broad, not elevated. Head moderately broad and depressed above; snout rather sharp, as long as eye, which is 3¾ in head; scales of medium size, the humeral scale not enlarged; two rows of scales on cheek. Fins all low and small; dorsal inserted posteriorly, its first ray opposite first of anal or slightly behind it; longest ray of dorsal 1¾ in head; anal larger than dorsal; pectoral short, 1½ in head; ventrals very short, reaching vent.

Coloration in life pale green, with small irregular horizontally oblong dark-brown spots scattered over head and body. Sexes not very different. Males with scales of body edged with black and with a pale lengthwise streak along upper part of each row of scales. Young with very obscure dark cross-bars. Fins plain, yellowish in male, speckled at base only.

Numerous specimens were obtained in Reedy Fork, Allemance Creek, Buffalo Creek, and other tributaries of the Cape Fear River, about Greensborough, N. C. A few were also obtained in Jumping Run, a small clear tributary of the Yadkin River, north of Salisbury, N. C. Like the related species, the present one seems to prefer clear upland brooks and springs.

This interesting species is named for Mr. Richard Rathbun, of the U. S. Fish Commission.

8. **Chologaster avitus** Jordan & Jenkins, sp. nov. (Type 39864, U. S. Nat. Mus.)
Closely allied to *Chologaster cornutus* Agassiz, but more slender, with shorter pectorals and different coloration.

Head, 3⅗ in length; depth, 5½ to 6½. D. 8 or 9. A. 8 or 9. Scales about 68. Length, 1⅘ inches.

General form of the Cave Blind fish, but much more slender, the head narrower, sharper, and less depressed; mouth oblique, terminal, the lower jaw projecting; maxillary extending nearly to front of eye; eye small, but evident, about half length of snout. Gill membranes separate, nearly free from the isthmus, covering the vent. Pectoral fin 1½ in head; 1⅗ in distance to front of dorsal; caudal pointed, about as long as head.

Color very dark brown above, the lower half of body abruptly white, all parts, black or white, sprinkled over with black points; side with three narrow, sharply defined, black lengthwise stripes, the lower sometimes breaking up into dots behind, the middle stripe broadest, forming the lower margin of the dark color of back, this stripe extending

on side of head across eye and snout; upper band a little nearer to line of back than to middle band; a large, irregular black blotch at base of caudal; behind this a white blotch of varying size, sometimes reduced to two small spots, sometimes forming a broad white bar, covering nearly half the fin; behind this blotch the caudal fin is jet black. Dorsal white, more or less spotted or edged with black.

About forty specimens of this very interesting species were taken in the outlet of Lake Drummond in the Dismal Swamp, near Suffolk, Va. The species probably abounds throughout the Dismal Swamp.

Our specimens agree in most respects with Putnam's description of *Chologaster cornutus* Agassiz. This species is still known only from three specimens obtained in a ditch in a rice field at Waccamaw, S. C. The differences are probably, however, of specific value.

Compared with its blind relative and perhaps descendant, *Typhlichthys subterraneus* Girard, *Chologaster avitus* is much more slender, with narrower, sharper, and less depressed head, sharper fins, and with the gill membranes less connected to the isthmus. The "horns" on the snout mentioned by Agassiz seem to be the flaps of the nostrils. These are much better developed in *Chologaster* than in *Typhlichthys subterraneus.*

9. Etheostoma rex Jordan & Evermann, sp. nov. (Type No. 39858, U. S. Nat. Mus.)
Subgenus *Percina* Haldeman, closely allied to *E. caprodes*.

Head, $3\frac{5}{6}$ in length; depth, $4\frac{3}{5}$. D. XIV–15. A. II, 11. Scales 11–83 to 85–19. Length of largest specimen, $5\frac{1}{2}$ inches.

Body elongate, little compressed, the form more robust than in *E. caprodes*, the back more elevated; head stouter, the snout more acuminate and the mouth a little larger than in *E. caprodes*; the head similarly formed. Cheeks with five rows of small scales; opercles and nape closely scaled; breast naked; gill membranes nearly separate; pseudobranchiæ very small; median scales on ventral line moderately enlarged. Fins higher than in *E. caprodes*, the longest ray of the soft dorsal slightly more than half head.

Adult in spirits mottled green above, yellowish below; four dark cross-blotches on back; about ten roundish dark blotches on sides, these almost confluent into a band; a small black spot at base of caudal; no trace in young or old of parallel cross-bands on side of back, the young with the back covered with zigzag markings, the sides with ten short vertical inky-black blotches about as high as the eye. Second dorsal and caudal in adult yellowish, with oblique cross-stripes of black spots; first dorsal yellowish, mottled, with a median dusky band; pectorals yellow, banded with olive; anal faintly spotted with black.

In life, the adult example was olive-green, straw-color below; back with five obscure dusky cross-blotches; nine obscure dark olive cross-blotches on sides; a small dark caudal spot. Snout and nape dashed with orange; cheeks yellow; first dorsal pale olive, with darker olive spots at base· a broad band of brilliant orange toward margin, the edge

dusky. Soft dorsal and caudal light yellow, with bands of black spots. Anal pale yellow, with two rows of olive spots; pectorals and ventrals yellow, with olive spots; ventrals edged with orange.

The smaller specimen had the dark blotches on side inky-black, the back more sharply mottled, and the orange on dorsal very faint.

Two specimens of this species were taken in swift water in the Roanoke River, near the city of Roanoke. The largest of these is $5\frac{1}{2}$ inches in length, almost as large as the largest of *E. caprodes*. It is probable that this species reaches a larger size than any other of the Darters. It is very close to *E. caprodes*, differing chiefly in the presence of red and green markings, in the larger scales, and in the more robust form.

10. Etheostoma roanoka Jordan & Jenkins, sp. nov. (Type 39866, U. S. Nat. Mus.)

Subgenus *Hadropterus* Agassiz, allied to *Etheostoma evides*.

Head, $3\frac{3}{4}$ to 4 in length; depth, $4\frac{1}{3}$ to $4\frac{3}{4}$. D. x or xi–11. A. ii, 8 or 9. Scales, 5–48–6, the number in lateral line varying from 41 to 50. Length, $2\frac{1}{2}$ inches.

Body decidedly robust, moderately compressed, the back elevated. Head broad, heavy, tapering forward, the snout moderately blunt at tip, then nearly straight from before eye backward to occiput. Premaxillaries not protractile. Maxillary $3\frac{2}{5}$ in head, reaching front of pupil. Mouth small, little oblique, low, the lower jaw included all around; teeth rather strong. Eye about as long as snout, $4\frac{1}{4}$ to $4\frac{3}{4}$ in head. Cheek scaleless, usually two or three small scales on upper part of opercle, the head often quite naked; nape and breast naked; middle line of belly with about eight moderately enlarged scales; preopercle entire; opercular spine moderate; gill membranes very slightly connected; lateral line complete; dorsal fins moderate, contiguous; anal large, its spines large, the first strongest; pectoral about as long as head, reaching beyond ventrals to vent. Caudal slightly lunate.

Color straw-yellow, the males dark green; sides with ten or eleven vertical cross-bars, more or less confluent into a lateral band. In the males, these bands are of a deep blue-green and vaguely defined. In the females, they are distinctly diamond-shaped and confluent along their middle, forming a broad band, with both edges serrate; male with lower parts and paler parts of head bright sulphur-yellow; back barred and mottled with dark; nape with a pale spot; head dark blue in males, with a black bar forward and one downward from eye; lips orange. Fins in male nearly plain blue-black; first dorsal with a median band of very bright yellow, its base with a black band, its edge narrowly black; second dorsal and anal faintly barred; some orange-yellow on ventrals, anal, and soft dorsal; two yellow spots at base of caudal, the upper forming a curved streak above the last of the dark lateral spots. Females paler, yellowish below, the markings black and less diffuse, the second dorsal and caudal sharply barred.

This beautiful species is very abundant in the Roanoke River in swift waters, especially among rocks covered with river-weed. Many speci-

mens were taken at Alleghany Springs, Salem, and Roanoke. It was also found abundant in the Neuse River, at Millburnie, near Raleigh, and two specimens were obtained from the Tar River, at Rocky Mount, N. C.

The North Carolina specimens have mostly larger scales (lateral line 45, 45, 41, 45, 48, 44, 42, 47, in eight specimens; 50, 43, 47, 50, in four Roanoke specimens), but are otherwise similar.

E. roanoka differs from *E. evides* chiefly in the larger scales. (Scales usually 60 to 65 in *E. evides*.)*

11. Etheostoma podostemone Jordan & Jenkins, sp. nov. (Type No. 39863, U. S. Nat. Mus.)

Subgenus *Boleosoma*, allied to *E. longimane*, differing chiefly in the larger scales and smaller mouth.

Head, $4\frac{2}{5}$ in length; depth, $5\frac{2}{3}$. D. x-13. A. I, 8. Scales, 4-35-6. Length, 2 inches.

Body rather stout, somewhat compressed, the back elevated. Head short, rather bluntly rounded in profile, the rather wide, blunt snout overhanging the small, inferior mouth. Upper jaw protractile; maxillary short, freely movable, just reaching front of eye, and scarcely as long as eye; eye $3\frac{3}{4}$ in head, a little longer than snout; mouth very small, inferior, contracted; teeth small; gill membranes broadly united. Cheeks, nape, and breast naked; opercles with a few large scales; preopercle entire; middle line of belly naked anteriorly, with ordinary scales behind. Lateral line complete. Dorsal fins moderate; anal fin lower and smaller than soft dorsal; anal spine short; first anal ray simple, a little longer than the spine and articulate toward tip; caudal truncate; pectorals rather long, one-fourth longer than head, reaching beyond ventrals to vent.

Color light yellowish-green, with seven or eight small dark quadrate spots along side; five or six larger ones along back; scales of back mostly with dark centers; a dark bar below eye; a little spot behind eye; a dark opercular bar and a dark bar before and behind pectorals; lower side of head with some dark spots; pectorals, both dorsals and caudal, with cross-bands of dark olive spots; dorsal in life also spotted with brownish-red; caudal also with a subterminal dark band; ventrals and anal nearly plain.

Many specimens of this species were obtained from the Roanoke River at Roanoke, Salem, and Alleghany Springs. They abound in swift water, especially among rocks covered with river-weed (*Podostemon ceratophyllus*). They are especially plentiful in the clear waters of Bottom Creek, about 5 miles above Alleghany Springs, Va. This swift mountain stream is one of the chief sources of the Roanoke.

This species is nearly allied to *E. longimane*, and like that species is intermediate between the groups known as *Boleosoma* and *Ulocentra*.

---

* Scales 52, 54, 55, 55, 60, 62, 65, 60, 62, 53, 62, 63, 52, 58, in fourteen specimens of *E. evides* from tributaries of the French Broad. In Indiana specimens the number rarely goes below 60.

12. Etheostoma verecundum Jordan & Evermann, sp. nov. (Type No. 39862, U. S. Nat. Mus.)

Subgenus *Ulocentra* Jordan, apparently allied to *E. stigmæum* and to *E. histrio.*

Head, 4½ in length; depth, 4½. D. XI, 11. A. II, 7. Scales, 6–47–9. Length, 2⅜ inches.

Form of head and body much as in *E. zonale*, the body subfusiform, little compressed, the back somewhat elevated. Head small; snout short, very convex in profile; eye large, longer than snout, 3¼ in head. Mouth small, inferior, horizontal; premaxillaries protractile, but with traces of an obsolete mesial frenum; maxillary extending to just beyond front of eye, 3¾ in head. Gill membranes broadly united; preopercle entire; cheeks, opercles, and nape scaly; breast naked; lateral line complete. Fins all very low; dorsal fins scarcely joined; caudal slightly lunate; pectorals as long as head, reaching tips of ventrals, not to vent.

Color in spirits greenish-yellow, much mottled with darker green; six or seven distinct quadrate green spots along lateral line; traces of three dark spots in a vertical row at base of caudal; a dark bar below and before eye; top of head dark. Ventrals and anal plain, other fins barred with dark olive; spinous dorsal with orange in front and orange spots on its last rays; tip of last spines dark.

A single specimen of this species was taken in the Middle Fork of the Holston River, about 5 miles south of Glade Spring, Va.

13. Etheostoma swannanoa Jordan & Evermann, sp. nov. (Type No. 39861, U. S. Nat. Mus.)

Subgenus *Nanostoma* Putnam. Allied to *E. blennius* Gilbert & Swain.

Head, 4⅓ in length; depth, 6. D. XI or XII, 12 to 14. A. II, 9. Scales, 6–48 to 57–* 7 or 8. Length, 2¼ to 3 inches.

Form of *Etheostoma simoterum.* Body robust, somewhat compressed, the back elevated; head very short, deep, the anterior profile strongly convex; snout short and blunt; eye large, placed high, 4 in head; mouth very small, horizontal, inferior, the lower jaw included all around. Premaxillaries not protractile; maxillary short, not adnate, reaching to opposite front of eye, 4 in head; teeth small. Cheeks, opercles, and breast naked; nape naked in one specimen; scaly in the others. Lateral line complete; belly evenly scaled. Gill membranes broadly connected. Fins rather low; dorsals contiguous; pectorals long, one-third longer than head, reaching beyond ventrals to vent.

Males, in spirits, dusky green, the belly paler; back irregularly mottled and blotched with black and strewn with specks of saffron yellow; six distinct black cross-blotches on dorsal line; eight to ten roundish or quadrate black blotches on sides, a smaller spot behind the last of these at base of caudal, these lateral blotches somewhat connected. Head dusky above; a faint bar below eye; axil black; fins nearly plain.

* Scales 50, 48, 53, 53, 54, 55, 56, 57, in eight specimens, the last three being from Holston River.

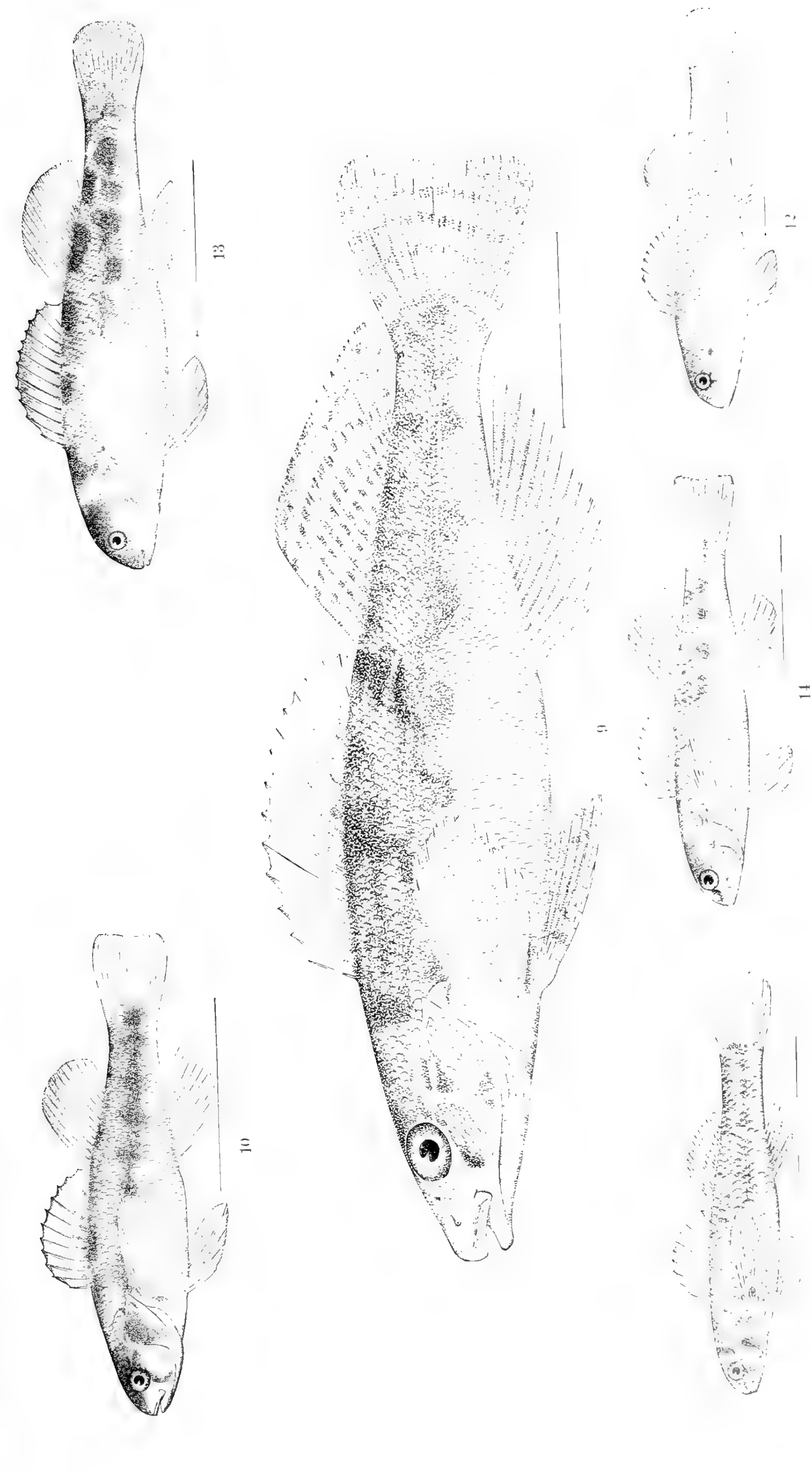


FIG. 9. *Etheostoma rex*, n. sp. (Page 357.)
FIG. 10. *Etheostoma roanoka*, n. sp. (Page 358.)
FIG. 11. *Etheostoma podostemone*, n. sp. (Page 359.)
FIG. 12. *Etheostoma verecundum*, n. sp. (Page 360.)
FIG. 13. *Etheostoma swannanoa*, n. sp. (Page 360.)
FIG. 14. *Etheostoma longimane* Jor. (Page 361.)

In life, male olive-green, light green below; markings all dark green; base and lower edge of pectoral tinged with saffron; base and tip of first dorsal bright snuffy-brown; second dorsal and caudal olive, speckled; lower fins pale yellow.

Female and younger specimens have the body more speckled; the pectorals and caudal barred with dark.

Ten specimens of this well-marked species were obtained. Two from the South Fork of the Holston River at Holstein Mills, Va.; two from the Middle Fork of the Holston at Marion, Va., and six from the South Fork of the Swannanoa River, at Black Mountain, N. C. The species apparently frequents only clear mountain streams.

14. Etheostoma longimane * Jordan. (No. 39865, U. S. Nat. Mus.)

Subgenus *Boleosoma* De Kay.

Head, $4\frac{2}{5}$ in length to base of caudal; depth, 5. D. x–13. A. I, 8. Scales 5–44–7. Largest specimen (Loch Laird, Va.), $2\frac{1}{2}$ inches long.

Body moderately elongate, not much compressed; head rather long, somewhat blunt anteriorly, convex above the eyes; profile of the snout steep and nearly straight; premaxillaries protractile; lower jaw included; maxillaries reaching front of orbit, about as long as eye, which is four in head, and about as long as snout; teeth rather strong; gill membranes a little connected; cheeks naked; opercles with some scales; nape and breast naked.

Lateral line complete; scales rather large; belly naked anteriorly, with ordinary scales posteriorly. Pectorals very long, reaching front of anal, about $1\frac{1}{2}$ times as long as head; ventrals long, but not reaching tips of pectorals nor front of anal. Dorsal spines high, the longest $1\frac{1}{5}$ in head; soft dorsal very high, $1\frac{1}{10}$ in head; anal smaller than soft dorsal; anal spine short, the first ray longer than the spine, simple, but articulate towards the tip. Caudal lunate.

Color in spirits straw-color, many scales on the back darker; ten dark spots on sides, rather irregular and small; one at base of caudal and one on front of opercle; back with five or six dark cross-blotches. Both dorsals with dark spots; caudal and pectoral somewhat barred; three or four dark bars only on caudal; ventrals and anal plain; a stripe forward from eye, but only a very faint dark shade below eye; a little black spot on base of pectoral above; sometimes faint dark dashes on lower part of side, alternating with the dark blotches.

In life this species is clear green, with markings of darker green or black.

This interesting species is common in tributaries of the James River in Virginia, abounding in rocky, swift waters, especially among river weeds. It is technically a "*Boleosoma*," but it is not very closely related to the *nigrum* group, but allied rather to those called *Ulocentra*.

---

* Originally described in Proc. Ac. Nat. Sci. Phila. 1888, p. 179, from specimens (No. 24619, Mus. Comp. Zool.) taken in a tributary of James River. The present description is drawn from better material.

Our specimens are from North River at Loch Laird, Va.; from Buffalo Creek, near Lexington, Va.: and from Elk Creek, near Natural Bridge. All of these streams flow into James River.

In this connection may be described the following species from Mexico:

15. Etheostoma australe Jordan, sp. nov. (Type 24625, Mus. Comp. Zool.)

Subgenus *Etheostoma*. Allied to *E. cæruleum* Storer.

Head, $3\frac{3}{4}$ in length; depth, $4\frac{1}{4}$. D. XI, 11. A. I. 8. Lat. l. 59. Length, 2 inches.

Form of *E. cæruleum*, mouth rather small, the lower jaw included; maxillary reaching front of pupil: eye small, about as long as the sharp, pointed snout, $4\frac{1}{2}$ to 5 in head: gill membranes slightly connected; cheeks, opercles, nape, and breast naked; lateral line incomplete. Fins in males rather high; anal fin with a single spine (in all three specimens), this spine long and quite strong.

Color in spirits: Males with ten oblique white cross-bands, probably scarlet in life, these alternating with white blotches on back; a dark spot below eye and a dark humeral spot. Female specimen (with eggs) speckled with dark cross-blotches on back; scales punctulate.

I have examined three specimens of this species collected in the Chihuahua River, Mexico, by John Potts. These specimens are among the original types of *Diplesion fasciatus* Girard (Proc. Ac. Nat. Sci. Phila., 1859, 101). The name *fasciatus* can not, however, be retained, as the prior *Catonotus fasciatus* Girard (*op. cit.*, p. 67) belongs also to the subgenus *Etheostoma*, being a synonym of *Etheostoma flabellare*.

U. S. FISH COMMISSION, *October* 5, 1888.

A STUDY OF THE BOOMERANG.

BY H. EGGERS, OF MILWAUKEE.

In the beginning of my studies I sought access to the literature on boomerangs and strove hard to hunt up everything written about them, but in such an out-of-the-way place as Milwaukee I succeeded but poorly, and whatever I read was either entirely false or only partially true or even invented. For example, the Encyclopædia Britannica, article "Boomerang," gives the manner of throwing wholly wrong, for just the reverse of its statement is true. Lubbock, in "Prehistoric Times," page 443, second edition, gives some correct statements, but they are useless for a person wishing to make a boomerang. Other communications in periodicals or daily papers are not worth mentioning. It is clear, after my experience, that those writers never handled this instrument or studied its properties closely enough to be entitled to publish anything about it. Some, for example, say it is a weapon of war. This can hardly be true, for the boomerang is a very costly instrument with the natives of Australia, considering the small number in every tribe that can make good ones and the difficulty they are under for want of proper tools; for the natives possessed but stone knives and stone hatchets to work the very hard wood the boomerangs are made of. One kind of this wood is the weeping-myale (*Acacia pendula*), which covers portions of eastern Australia for miles; but I think the boomerang is made also of other hard and heavy woods. Now the boomerang can not be a weapon of precision, and even if in a skirmish somebody be hit, it is of small execution, and the instrument is then lost. A stone or a common club will do more harm and is evidently much cheaper. Their spears, which can be manufactured by much less work, are dangerous weapons, as the natives throw them about 90 feet with sure aim; or, according to Captain Cook, a distance of 50 yards. From these reasons alone I believe the pretension that the boomerang is a weapon of war must fall to the ground. This opinion is supported by the testimony of Mr. Oldfield (Lubbock, *l. c.*). This gentleman says: "The boomerang is but little used in war."

But the boomerang is a good weapon for hunting birds; not that it would be thrown at a single bird with some chance of success, but it is very effective when hurled among a large flock of flying birds. The rapidity with which the instrument rises and the comparatively large space it describes will almost insure the hitting of a bird, and then bird and boomerang both will fall to the ground on nearly the same spot. But when the boomerang does not strike a bird it will then return near to the hunter, if it was properly thrown. Another false opin-

ion is that the natives strike with the boomerang a bird sitting on the branch of a tree; for the probability is that the instrument will break or get entangled and stuck among the twigs of the tree, as it sometimes happened in my practice. Another saying is that the boomerang is applied for hitting and killing kangaroos. This may be possible when the animal is very near to the hunter, say 30 or 40 feet distant, but I doubt that a boomerang will disable a kangaroo, whereas a spear will fell it to the ground.

Mr. Oldfield goes on to say:

> The natives never attempt to kill a solitary bird or beast by means of the boomerang. On the other hand, in swampy localities, where water-fowl congregate largely, the boomerang is of essential use, for a great number of them being simultaneously hurled into a large flock of water-fowl insures the capture of considerable numbers.

It is not necessary to reflect any more upon such wonderful tales of what a boomerang in a dexterous hand will possibly perform. A person that takes the trouble to practice with this instrument will soon see which of such tales are tenable and which are not. The generally credulous public swallow such stories the more readily the more wonderful things they relate.

CONSTRUCTION OF THE BOOMERANG.

By my experience I am led to believe that there exist, perhaps, different general forms of boomerangs equally perfect; but I would make sure only of one general form, which, however, can vary between pretty wide limits. The two instruments sent by me to the Smithsonian are representations of this form. (Figs. 1, 2.)

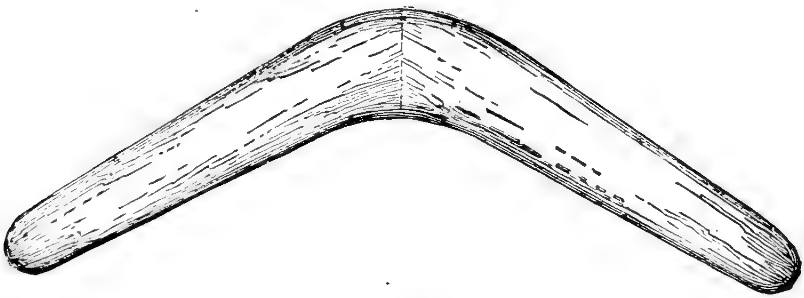


FIG. 1.

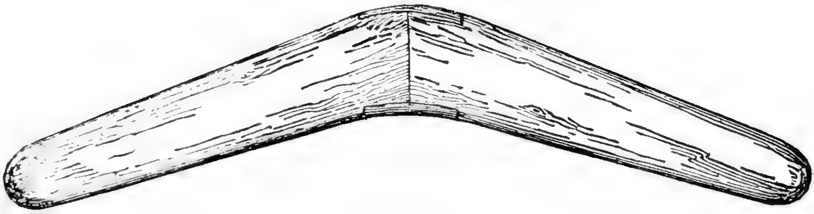


FIG. 2.

The boomerang, according to those specimens, consists of two symmetrical wings; that is, symmetrical in regard to a plane by which these two wings are joined.

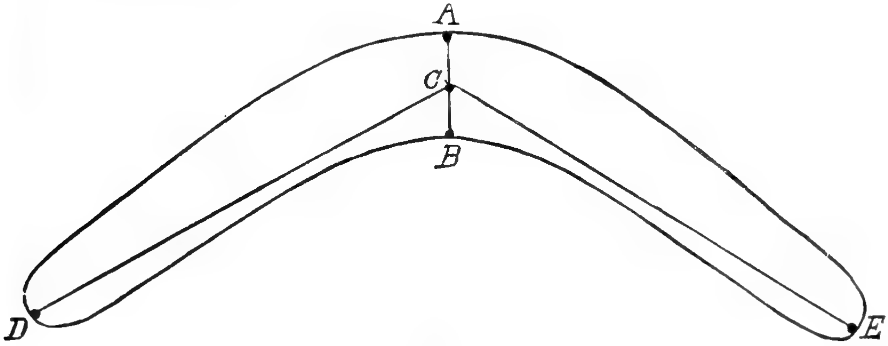


FIG. 3.

The angle of the lines D C and E C, which pass through the center C of line A B, and also through the centers D and E of the ends, I will call the "angle of the boomerang." The size of this angle varies between wide limits. My instruments have angles from 100 up to 140 degrees, and yet all these different instruments can be made to work properly; that is, boomerang-fashion. Perhaps this circumstance is the principal reason that the boomerang is at all popular in Australia. For if the efficacy of this instrument were limited by an angle of a fixed size, how few branches of trees would be found suitable. However, certain sizes of angle are more convenient to the thrower than others, and I found that angles from 116 to 120 degrees are very convenient. The relation between thickness, breadth, and length, absolute weight of the boomerang, and specific gravity of its material can very probably be expressed by numbers, but they are unknown, and evidently vary also between extended limits. The instruments sent to the Smithsonian have very nearly the numbers 1: 6: 36; that is, the maximum breadth is six times the maximum thickness, and the length of each wing is six times its maximum breadth. But writing $5\frac{1}{2}$ instead of 6 in the above proportion, so that the latter would be $1 : 5\frac{1}{2} : (5\frac{1}{2})^2$, would be just as near the ideal numerical relations. I am inclined to believe that these numbers are influenced by the specific gravity of the material. That the above proportion does not entirely govern the geometrical form of the boomerang, I conclude from the fact that after breaking part of the wing (say one-fourth of its length) off from a good instrument, I did not notice any material loss of its good quality.

Lubbock has given the measurements of one boomerang and Professor Erdman at Berlin, Germany, the dimensions of three others. These measurements may serve as a guide to a superficial construction of the boomerang; but these writers do not mention, as it seems to me, the essential point of a good boomerang: "the angle of inclination of the two wings." The wings of my instruments have each a plane side.

These two planes have to form a small angle between them, and I found that the way of effectively throwing the instrument and the manner of throwing it depend mostly on the size of this angle of inclination, which may vary from zero to three degrees, although the number 3 is not the utmost limit for successful throwing. The greater the angle between these limits, the less inclined toward the horizon the initial plane of rotation must be, all other points being the same. Instead of a plane, one side of each wing may form a curved surface little deviating from a plane, without the quality of the instrument being impaired. For brevity's sake, the joined planes of the two wings may be termed the plane side or lower side of the boomerang; it is the side facing the ground during the flight. The opposite surface of the boomerang may be termed the rounded or upper side. The surface form of this side seems to be quite arbitrary; however, a good form and perhaps the best one is such that the instrument, placed with this (upper) side on a plane table, fits the table exactly either by a plane surface or by a plane curve. In practice an approximation to this demand is sufficient; also a moderate upward curving of both wings will answer.

The tapering of the wings from the middle of the instrument toward the ends may be very slight both in regard to thickness and breadth; for example, if the instrument is three-eighths of an inch thick in the middle, it may be two-eighths of an inch at the ends, and if $2\frac{1}{2}$ inches broad in the middle, it may have $1\frac{3}{4}$ inches at the ends.

It may not be out of place here to mention a curious instance transmitted from antiquity. The old Grecian geographer, Strabo (book IV, chapter IV, 3), says:

> The Gauls use a piece of wood resembling a pilum, which they hurl not out of a thong, but from their hand, and to a farther distance than an arrow. They principally make use of it in shooting birds.

APPROXIMATE THEORY OF ITS FLIGHT.

As to the mechanical theory of the flight of the boomerang I can say but little. Firstly, the rotation of the instrument about its free axis through the center of gravity is the fundamental condition of success. The faster the rotation, the longer the boomerang floats in the air.

Secondly, the nutation of the axis of rotation has to be considered. This nutation decreases with the angle of inclination of the two wings of the boomerang and increases with the increase of the said angle. In the case of a small angle, the plane of rotation keeps parallel to the initial position of this plane, or very nearly so. If the two wings form one plane with their lower sides (this angle being zero), the instrument has no perceptible nutation, and must be thrown perpendicularly to the vertical plane passing through the hand. The instrument then rises and returns nearly in the same plane that it went up. This throw is rather difficult. In the second case, the angle of inclination of the two

wings being rather large, the plane of rotation is constantly changing in regard to its inclination with the horizon, and by this circumstance causes the instrument to describe a series of complicated curves like those of a large bird of prey before it settles at the feet of the thrower. In general the initial plane of rotation must form an acute angle with the horizon, which may increase to a right angle when the inclination of the two wings is nearing its maximum.

A very elaborate mathematical treatise on the boomerang has been published by Prof. Werner Stille, Highland, Ill. It is a communication to Poggendorf's Annalen der Physik, published at Berlin, Germany. Mr. Stille starts from the supposition that the boomerang should form a skew surface, a kind of screw. Accidentally I possessed an instrument of a screw-like form. When properly thrown it screwed up all right, but did not return.

HOW TO THROW THE BOOMERANG.

Take the boomerang with the full fist by one end, so that the flat side of the instrument faces the ground, and then fling it away with outstretched arm, giving it at the same time a rotatory motion by a jerk with the wrist. In the moment of leaving the hand the boomerang should have an inclination toward the left, and its progressive motion should be in an upward direction under a certain angle of elevation. The angle of inclination to the left and the angle of elevation vary from one instrument to another, and have to be ascertained by some gentle trial throws for any particular instrument before the thrower applies the full power of his arm. The field for practice should be soft ground, free of stones or other hard objects. Throw it against the wind, or half against it. Do not practice when a hard breeze is blowing.

I do not enlarge here on the different curves the boomerang describes in accordance to its form and the manner of throwing, for it would be unintelligible, unless illustrated by actual experiment.

LIST OF PLANTS FROM LOWER CALIFORNIA SENT TO THE SMITHSONIAN INSTITUTION BY LIEUT CHARLES F. POND, U. S. NAVY.*

BY DR. GEORGE VASEY.

First collection, made on the southwest end of Cedros Island, in February, 1889:

1. Oligomeris subulata, *Delile.*
2. Isomeris arborea, *Nutt.*
3. Porophyllum gracile, *Benth.*
4. Baccharis sarothroides, *Gray.*
5. Encelia conspersa, *Benth.*
6. Viguirea lanata, *Kell.*
7. Physalis peduneulata, *Greene.*
8. Pentstemon Cedrosensis, *Kell.*
9. Heliotropium Curassavicum, *Linn.*
10. Chenopodium murale, *Linn.*
11. Mirabilis Californica, *Greene.*
12. Harfordia fruticosa, *Greene.*
13. Eriogonum Pondii, *Greene.*

Second collection, made on San Bonito Island, February, 1889:

1. Escholtzia ramosa, *Greene.*
2. Lepidium lasiocarpum, *Nutt.*
3. Lavatera venosa, *Watson.*
4. Cotyledon lanceolata, *Nutt.*
5. Frankenia Palmeri, *Gray.*
6. Hemizonia Streetsii, *Gray.*
7. Amblyopappus pusillus, *Hook.*
8. Trixis angustifolia, *D. C.*
9. Perityle Californica, *Torr.*
10. Cryptanthe patula, *Greene.*
11. Mirabilis Californica, *Gray.*
12. Atriplex dilatata, *Greene.*
13. Plantago Patagonica, *Jacq.*
14. Brodiæa capitata, *Benth.*

WASHINGTON, D. C., *March* 29, 1889.

---

* Collected while engaged in a survey of the coast of Lower California on the U. S. S. *Ranger.*

A STUDY OF THE AMERICAN SPECIES OF VERTIGO CONTAINED IN THE U. S. NATIONAL MUSEUM, WITH THE DESCRIPTION OF A NEW SUBGENUS OF PUPIDÆ.

BY V. STERKI, M. D., OF NEW PHILADELPHIA, OHIO.

(With Plate XLII.)

The North American forms of *Pupa* are far from being well known: this is especially the case with those belonging to the genus *Vertigo*. Though among the most interesting of all our mollusca, the shells of this section of the *Pupidæ* seem to be the most neglected. This may be due to two causes: First, their minute size and the supposed or real difficulty in collecting them; and, second, their apparent similarity and the critical skill required to separate and determine them. The multitude of features and the possibilities of their combination are greater than generally realized, but since many of their characteristics are rather constant, it is not so difficult to separate and define the different species as appears at first. Once become familiar with these little creatures and the observer will find them far more manageable than many a group with much larger shells, just as a botanist at first dreads the determining of *Cyperaceæ*, and when versed in them likes them better than any others.

The Vertigos are particularly interesting because of their close relationship to European species. When the American species have been as thoroughly studied and are as well known as those of the Old World, it will probably be found that they form part of the great circumboreal land-shell fauna—like other groups of the mollusca that are distributed through the north temperate zone in the contiguous continents. They exhibit analogous features of resemblance and vary perhaps not in so extreme a degree as the *Limnæas*, but as much as other members of the fauna as a whole, aside from the *Protozoa*. For this reason it would be worth while for collectors to obtain as many specimens as they can, since not only new species will doubtless be detected, but with an abundance of material it will be possible to study their variations throughout the continent, and last, but not least, their geographical distribution, and enable us to make a comparison of the same with that of the Old World. For some time past I have been studying our Vertigos as far as I could obtain specimens from different States, and have compared them with European forms. The results obtained appear to me interesting enough to be published, at least in part. Considering the few species thus far described the results are not definite, and I have been careful to make no conclusions beyond such as follow directly from the examination of the material in hand. This has been for the most part only the shells; as

July 5, 1889.

to the soft parts my material has not been sufficient nor my study pursued far enough to warrant present consideration.

I shall not here present any systematic description of species—old or new—nor enter into critical discussions about synonomy, etc., except in a few cases necessary to my purpose, leaving such questions for later publication. The present will be only a general statement of a part of the characteristics of the *Vertigo* group as obtained by comparing North American and European species and forms, and the conclusions arising therefrom. These latter necessarily lead to the creation of a new subgenus of *Pupa* in order to properly segregate and place a few species, which in our sense are essentially different from the Vertigos. It is not necessary for our purpose to describe all parts and features of the Vertigo shell. Its size, shape, striation, coloration, whether umbilicated (widely or narrowly perforated) or not; the number and shape of the whorls, the relative size of the latter in respect to the ratio of their growth, the sutural character, etc., all of these we will put aside, and direct our attention to two principal points, closely connected, namely, the configuration of the last whorl near the aperture and of the latter itself, and its denticles. This last term is used for convenience, and has nothing to do with the odontophore of the animal, but refers only to the lamellæ of the aperture. The latter is of nearly similar shape in all the Vertigos; more or less half-oval or rounded, except at one point a little above the middle of the outer wall, or peristome, where there is, in some species, an indentation dividing the outer margin in two parts or curves, the upper of which is the smaller. (See Plate XLII, Figs. 1, 5, 6, 9, 11.) There are gradual differences in this feature, and many species show only a trace of that indentation, or slight flattening of the outer wall (Figs. 4, 9). Occasionally this point projects beyond the plane of the margin, as a rather prominent angle in some species, *e. g.*, *V. ovata* Say, or as a slightly rounded elevation in others; a few have scarcely a trace of it. It is seen when looking vertically at the plane of the aperture. This is a feature by no means peculiar to Vertigo; in many gastropod shells it is more or less perceptible, especially in most of our land and fresh water "snails," although in few so marked as in *V. antivertigo*, Drap., and some others, among which are *P. milium*, Gld., and *P. venetzii* Charp. At a little distance from the outer margin and parallel to it and to the lines of growth there is an elevation, in form of a prominent crest, separated from the margin by a more or less deep groove or constriction. (See Fig. 7×.) But there are again great differences in the aspect of this; in many species the crest is scarcely perceptible and the whorl continues with little change of form to the very margin, which then is generally not at all or but slightly expanded (Fig. 3), while it is considerably so in those species showing the above-named configuration in a marked degree. (Fig. 7.)

Inside, corresponding to the crest on the outside, many species show a callosity extending from the base to the suture, very variable in thick-

ness, and often of a lighter color than the shell, appearing as a crimson or otherwise colored "collar," as one of my correspondents terms it. Generally those species have it more conspicuously developed that have a prominent crest and strong lamellæ, but there are exceptions; thus a species undescribed, so far as I know, from Colorado (Table, No. 9), showing the last-mentioned feature, has not a trace of a callus, or at least my specimens have not. That there are differences in this respect in one and the same species, *V. curvidens*, Gld., furnishes proof; most of my specimens—I have them from various places in Ohio and several other States—have a well developed and often very strong callosity, while a few from Maine show no trace of it. This is constant in a number of species with simple last whorl and straight peristome, as *V. alpestris* Alder. That the callus is the homologue of the thickened lip in most of our Helices, etc., there can be no doubt.

Still another feature has to be considered in this connection. Behind the crest named above—behind, if we suppose the plane of the aperture to be in front—there is in some of the species a depression in the last whorl. It is not very deep, well defined below (towards the base), gradually disappearing above (towards the suture), occupying about the half of the middle of the whorl. Although this may appear trifling, I consider it a valuable feature in defining certain forms and species of Vertigo as well shown in *V. ovata* Say. (Fig. 7 at ×.)

The second of the main points is the dentition, a prominent feature in this group, so striking, indeed, that it has probably had too much importance given to it in many descriptions of species, while other characters of equal value have been more or less neglected. And yet, nevertheless, it has not been studied with sufficient care, especially its occurrence and aspect as a whole, both in its grouping and as to the shape of the separate *lamellæ*. This latter term I think to be better than "teeth" or "denticles," for it defines more correctly their real shape and typical value, as all of these, even the smallest, appear as lamellæ or folds, if examined with a magnifier of sufficient power, though in some instances they are only quite rudimentary. So far as known they vary in number and shape. Notwithstanding their variability in these respects, there is exceeding persistency in the matter of position, not only in the same species, but throughout the whole group of Vertigo; that is, if present at all. It appears, therefore, that the position of the lamellæ is of greater importance than their prominence. Whether one of these be strongly developed, small, or entirely wanting, it has its own particular or typically local place, and we know which are present and which wanting. This point, therefore, should be stated in descriptions. To appreciate this character requires a very critical examination, but once understood it facilitates diagnosis very materially. (Compare figs. 1–4, 6, 9.)

As already stated, the number and size of the lamellæ vary in different species. In general those with the crest near the aperture, with a

callosity and expanded margin, have also the most highly developed folds; such as *V. antivertigo* Drap. (Europe), and *ovata* Say (N. Am.), while in species with a simple configuration of these parts they are few and small. To return to these relations: the number of lamellæ may vary from three, or perhaps less, up to ten or even twelve or fourteen. (See figs. 1–5, 6, 9.) Five of them are the most characteristic and typical, because the most constant and at the same time, in most cases, the largest. For many years I regarded them as primaries; the others as accessories. This was in Europe, when I had no species from North America; but the latter so far as I know them, agree quite well with those of the European continent, in general appearance and structure.

The primary lamellæ are as follows, designated with letters (see fig. 5): one on the apertural wall or body whorl A; one on the columella B; one at or near the base C; two in the outer margin or peristome D and E. A is the most constant in shape, being a well developed, rather high lamella, steeply ascending at the ends, differing somewhat in size, and in its being inclined to the inner or outer side in some species (hence the name "curvidens"), as in the figure.

B, if not closely looked at, appears to be simply a projecting tooth in the columella while it is a true lamella, encircling the pillar in a direction nearly rectangular to the axis. It is a good plan in order to gain an idea of its configuration and also of that of the others, to examine and compare larger *Pupa* with well developed folds, *e.g.*, *P. dolium* Drap., and *P. torquillas*, or our N. American *P. armifera* and *P. contracta*, in which of course the lamellæ are partly of another type and shape. In none of the Vertigo species I know is the columellar fold wanting.

C is the least constant of all the primary folds, in fact in most instances absent, and even in one and the same species it may be present, or not, as in *P. pygmæa* Drap. And yet there are reasons for considering it not merely an accessory. It appears like a simple *tooth*, rather variable in size, but really it is a *lamella*, although the shortest of the primaries. In most instances its position is not exactly at the base, but a little nearer the columella (see figs. 1–3, 5), so that many descriptions say that there are two "teeth" on the pillar, yet generally it is seen through the transparent shell quite near the lowest part of the latter, which is hardly a part of the columella.

The two lamellæ on the peristome are always easily recognizable as such, but of very different dimensions. Where there is a callus, as described above, they generally end in it, either beginning rather distant from it in the "throat" or quite near, then sometimes simply appearing to be a nodule upon it, especially when they are small. (Fig. 2.) Very generally they are absolutely and relatively smaller in species having no callosity and are isolated (Figs. 3, 4), while in others the callus connects them. The lower of the two, D, is remarkably constant, and in this regard, together with B, keeps the first rank, while the upper, E,

may be absent or represented by a mere trace, as in *V. alpestris* Ald., and *V. tridentata* Wolf. (Figs. 4, 9.)

Another peculiarity and really quite a prominent feature is that D in all species stands a trifle more remote from the margin, as can be seen also from the outside, at least in the majority of species. The position and direction of the upper fold E is so that its prolongation would reach the margin just at the projecting angle or point mentioned above (Figs. 1, 5), and sometimes there is a slight depression corresponding to the lamella. In more instances this is at the place of the lower lamella D, and in some species it coincides with the lower limit of the depressed part described above, corresponding to the space between the two folds.

The accessory lamellæ are in general less frequent and partly less constant, and smaller than the primaries, and thus less typical. A part of them are quite constant (1) towards the margin, in the direction of the coil of the shell, while others are very variable, present, or only a trace, or entirely wanting; but they always occupy certain definite places. These are (see corresponding numbers in Fig. 5):

(1) On the body whorl, between lamella A and the upper (outer) angle almost always nearer the margin. A lamella well developed in many species, especially in *V. pusilla* Müller, *V. substriata* Jeffr., both of Europe; smaller but distinctly lamellar in *V. antivertigo* Drp., in *V. ovata* Say, and in a species from Colorado (Table, No. 9); as a small nodule scarcely recognizable as a lamella in *V. moulinsiana* Drp. (Binney's Gould); sometimes absent and sometimes present in *V. pentodon* Say, and *V. curvidens* Gld., of the same shape. It certainly is the most significant of the accessories and for the first-named species quite characteristic.

(1*a*) In some specimens of *V. ovata* Say, *e. g.*, from Portage County, Ohio, there is a small but distinct nodule between the last named and the angle of the margin; also in occasional specimens of *V. antivertigo*.

On the body whorl, the margin is represented by an apparently more or less marked callosity between the upper ends of the columella and outer margin; it is really the limit of the deposit all over the body whorl within the aperture.

(2) On the body whorl, on the other side of A, between this and the columella, a small nodular lamella, rather constant in *V. antivertigo* and *V. ovata*, not infrequent in *V. pentodon* and *V. curvidens* Gld.

(2*a*) As to *P. venetzii* Charp., and *P. milium* Gld., see text below.

(3) Between C and D, a denticular lamella rather frequent, sometimes double, as in *V. ovata* and *V. pentodon*.

(4) Between D and E a small but quite distinct fold observed thus far only in several specimens of the two last-named species and their relatives.

(5) Above E one denticular lamella, constant in *V. antivertigo* and *V. ovata*, usually present in *V. pentodon* and *V. curvidens*, and frequently exhibited in *V. pygmæa* Drap.

(6) Above the last, near the suture, there is a small but distinct denticle in most examples of *V. antivertigo*, and it is sometimes seen in specimens of *V. pentodon* from Texas.

It has already been stated that in general the accessory lamellæ are smaller than the primaries, especially in *V. antivertigo* and *V. ovata*, as the former 1, 1*a*, 2, 3, 4, 5, 6 show in Figs. 1, 5, when compared with the latter A, B, C, D, E. But in certain species the differences in size are not so striking, *e. g.* in many specimens of *V. pentodon* Say and *V. curvidens* Gld., where the principals are not at all conspicuously large; here sometimes there is a row of fifteen to seven nearly equal lamellæ from the base to the suture (see Fig. 2), so that D and E are scarcely or not at all recognizable by their size, but only by their positions and the fact that they are constant, well developed in specimens where the others are wanting. Besides, D is always a trifle larger, inward, and there is on the outside a nearly corresponding impression or at least a rough line.

From the description and the table it is evident that there is a line, I venture to say of development, among the species of *Vertigo* from the simpler to the complicated—from the lower to the higher. The former are represented by those species with simple configuration of last whorl and aperture, as already pointed out, with few and small lamellæ, as in *V. alpestris* and *V. ronnebyensis;* then in *V. tridentata;* from these we come to forms gradually differentiated and more complicated till we reach the end of the series in *V. antivertigo* and *V. ovata*, in which all the features above described are conspicuously developed; the crest and depression in the last whorl, the expanded margin, the projecting and at the same time impressed angle of the peristome, callosity, and the number and size of the lamellæ, (compare figs. 6, 9).

In the following table I give a few examples of parallel or nearly parallel species from both continents.

EUROPE.	NORTH AMERICA.
V. antivertigo Drap.	*V. ovata* Say.
V. substriata Jeffr.	*V. gouldii* Binn.
V. pygmæa Drap.	*V. indesc.* (Mass., Ohio).
V. lilljeborgii West.	*V. tridentata* Wolf.
V. alpestris Alder.	None ?

Better knowledge of our North American fauna will probably bring to light more such corresponding forms.

It is evident at once that those forms of Vertigo with cylindrical shape, slowly increasing whorls, relatively small and simple aperture, *e. g., V. alpestris*, stand nearest to some *Isthmias*, and that both of these groups originated and differentiated from a common root. In North America the types of Vertigo in general are about the same as in Europe, although the species differ, and although a smaller number has been described so far. It is a noticeable fact that there are on our continent no species of *Isthmia*, but it must also be added that no form like *V. alpestris* has as yet been found here.

Designating the primary lamellæ, when present, by their letters and the accessories by dots, we obtain a formula for the dentition of a certain species. The following table is the list of such formulæ for a number of North American and European species, and contains a few hitherto not generally included with the Vertigos.

	Name.	Origin.	Formula.	Remarks.
1	*V. pentodon*, Say	N. America	A B C . D E .	
a	......do	......do	A . B C . D . E	
b	......do	......do	. A . B C . . D E .	
c	......do	......do	A B C . D E	Etc.
d	......do	N. America—Tex	A . B C . E . .	
2	*V. floridana*, Dall.[1 2]	N. America—Fla	. A . B C . D . E .	
3	*V. curvidens*, Gld.[1 3]	......do	A . B C . D E .	
a	......do	......do	A . B C . D . E .	Etc.
b	......do	......do	A B C D E	Rare.
4	*V. antivertigo*, Drap.[4 5]	Europe	. A . B C . D E .	Up to :
a	......do	......do	. . A . B C . . D . E . .	
5	*V. ovata*, Say[4 6]	N. America	. A . B C . D E .	
a	......do	......do	. A . B C . . D . E . .	
b	......do	N. America—Ohio	. . A . B C . D . E .	
c	*V. ovata*, var.[7]	N. America, Roan Mountain	. A B C D E	
d	*V. ovata*, var.?[8]	N. America—Ill	A B C D E	
6	*V. moulinsiana*, Drp	Europe	. A B C . D E	
a	......do	......do	A B C D E	
7	*V. substriata*, Jeffr.[9]	......do	. A B C D E	
8	*V. pusilla*, Müll.[1]	......do	. A B C D E	Sinistral.
9	*V. indescr*[10]	N. America—Colo	. A B C D E	
10	*V. indescr*[11]	N. America—Mass., Ohio	A B C . D E	
11	*V. pygmæa*, Drap	Europe	A B C D E	
a	......do	......do	A B C D E .	
b	......do	......do	A B D E	
12	*V. gouldii*, Binn.[9]	N. America—Mass., Conn	. A B C D E	
a	......do	N. America—Me., Ohio	A B C D E	
13	*V. californica*, Rowell[1]	N. America—Pacific	A B D E	
14	*V. lilljeborgii*, West	Europe, north	A B D E	
15	*V. tridentata*, Wolf[12]	N. America	A B D *e*[8]	
16	*V. ronnebyensis*, West	Europe, north	A B D *e*	
17	*V. alpestris*, Alder	......do	A B D *e*	
a	*V. alpestris*, Var	......do	A B D	
18	*V. heldii*, Cless		B D E	
19	*P. venetzii*, Charp[1]		: A B C D E +	Sinistral.
20	*P. milium*, Gld.[1]		. A . B C D + E .	

[1] For the systematic position of these species see text below.

[2] From descriptions and figure in Proc. U. S. Nat. Mus. VIII (1885), p. 261.

[3] Quite distinct from *V. pentodon*, to judge from specimens from many localities in several States, though certain examples of either species seem to come very near to each other. They need further investigation.

[4] *V. antivertigo* Drap. and *V. ovata* Say have almost exactly the same dentition as to number, size, and shape, and places of the single lamellæ. And also as to other features of the shells, they are very similar. *V. ovata*, in general is a little larger, of lighter coloration, the margin is somewhat more expanded; the aperture appears larger because the columellar margin is relatively a trifle shorter; the whorls increase in size somewhat more rapidly, and the suture is a trifle deeper: specimens from Massachusetts are not only of the same or even a darker shade, but also of the same and sometimes of a smaller size, and other distinguishing features are slightly marked. They resemble each other so much that it is difficult to separate them, and if collected at the same place no one would regard them as even distinct varieties. I hesitate, however, to declare them identical because I have not yet made a comparison of the soft parts. Doubtless they are parallel forms, and if found on the same continent, would be regarded as varieties of one species. Compare also the following notes:

[5] *V. antivertigo* Drap., is remarkably constant throughout Europe so far as I know it, while

[6] *V. ovata* Say is on the contrary quite variable, owing, possibly, to the greater differences in climate Also a few decided varieties exist and may be more will be found; the future study of these forms is likely to be of great interest.

[7] A trifle smaller than the average, perforated, the only form I know with this character.

[8] Considerably smaller, conical, shell thin, appears to be a different species, but possibly connected with the types by intermediate forms.

[9] *V. substriata* Jeffr., and *V. gouldii*, Binney (fig. 3) are nearly related. In the former the lamellæ are usually a little larger, especially the accessory No. 1, and the whorls larger and less in number; both are regularly striated. Accessory No. 1 (or body whorl) very small in *V. gouldii*, and quite near A, but absent in specimens from various localities.

[10] In general appearance similar to *V. pygmæa* Drap.

[11] Rather large cylindrical, chestnut colored.

[12] Is as valid a species as any other of North America. Collected at different places in Ohio and Illinois; very nearly allied to *V. lilljeborgii* Westerland, of Sweden, a relation well worthy of being studied more closely. In the formulæ of this and the two following species the "*e*" indicates that the upper primary lamellæ in the peristome are very small or entirely wanting. Also in *lilljeborgi* the same is quite small, to judge from the few specimens in my hands.

There are apparently relations to other groups; thus to *Pupilla* (partly by species not named in the table), and to *Leucochila*, many of which show nearly the same dentition as the Vertigos.

As to deducing a final conclusion from the facts presented, in the matters of relationship on the one hand and geographical-geological distribution on the other, I do not at this time feel competent; an attempt to do so might result in at least a partial failure; especially because the soft parts require to be compared and the fossils of the various groups must yet be subjected to careful consideration.

One question more is suggested here: Whether Vertigo is to be considered a genus or only a subgenus of *Pupa*. The leading conchologists are of different opinions about it. It seems to me that our group is by intermediate forms connected with other subgenera of *Pupa*, therefore I still prefer to include it among the latter, though I shall study the question further.

Following the above considerations, I desire to direct the attention of conchologists to some species that require to be placed among the Vertigos which have hitherto been regarded as belonging to other groups, and a few others that require to be removed therefrom. Among the former is *V. pentodon* Say * (Fig. 2), and related forms; *V. curvidens* Gld. (probably identical with *V. pellucida* Pfr.), and *V. floridana* Dall. These have been recently placed in *Pupilla* and even in *Leucochila*, although Say had already written *Vertigo pentodon*. In shape and dentition their shells entirely agree with Vertigo, and do not agree with the other named groups. Also, the soft parts, as to jaw and odontophore, seem to exhibit no objection to this union. The only difference is the coloration of the shell, but in other genera and groups of *Pupa* albino forms occur as well as "colored." If *Vertigo pentodon* had a brown instead of a whitish shell it probably would have been placed elsewhere. These forms certainly represent a peculiar group of Vertigo, but, as before stated, their proper place is here.

Very probably *P. decora* Gld., *P. californica* Rowell, with *P. rowellii* Newc., and a few others of our continent are to be, and for certain good reasons have been, placed with Vertigo. Their general form, and more specially their dentition, are sufficient reasons for so doing. When Morse placed his *P. corpulenta* and *P. bollesiana* in *Isthmia*, it was equivalent to arranging them with the Vertigos, the connection and extent of *Isthmia* having been so restricted by European conchologists.

P. rupicola Say, and *P. corticaria* Say, at one time also included with Vertigo, are of a different type. Although bearing some features of that group, the former is quite variable, at least in many instances. It will suffice here to indicate these points; in order to settle them, more study and comparison is required.

---

* In *V. pentodon* the principal D begins also a trifle deeper in the throat than E, at least in the specimens I have seen from different parts of the United States. (Confr. Dall *l. c.*, p. 262.)

P. simplex Gld. has also been arranged among Vertigo by a number of prominent conchologists. No further proof is wanting to show that its place is not here; it should be stated, however, that it is absolutely identical with *P. edentula* Drap., inhabiting the Old World as well as the New. By European conchologists it is regarded as the main recent representative of the group or subgenus *Edentulina*. Draparnaud's name will have to be substituted for Gould's.

We will now consider two species deserving of special attention, both European, viz, *P. pusilla* Müll., and *P. venetzii* Charp. (*P. angustior* Jeffr.), which have been placed in a group of Vertigo under the subgeneric name of *Vertilla*, both of them being sinistrorsal or reversed forms. After a critical examination and comparison I came to the conclusion that one of them, the latter, is nearly related to our North American *P. milium* Gld., while *P. pusilla* is quite different.

One thing which at first attracted my attention, the fact that each of these has a very long lamella in the outer wall (fig 10), which is readily seen through the transparent shell (figs. 12,13), but while in *P. venetzii* the upper, E, is the largest, in *P. milium* it is the lower, D. Now, a careful examination will reveal the fact to any observer that in position each of these long folds is different from the other, but that the folds themselves are alike in both species; a morphological element quite unique. It is a long, thin, high lamella, beginning rather deep in the throat, and close to the base, in a direction with or near the lines of growth, then turning upward and toward the aperture, and meeting the lower primary lamella D in *P. milium*, and the upper E in *venetzii*. This may appear as a rather bold assertion, yet, nevertheless, I believe it to be in conformity with nature, and moreover it is not without analogy, as it is well known in many *Clausilias* two lamellæ on the body whorl may be entirely separate, or again, otherwise unite in apparently one, in which, however, a careful examination will detect the two elements, and nearly the same is to be seen in some Pupæ. May not the lamella in question be regarded as the homologue of the lunar, and partly gular fold of *Clausilia*, only more differentiated in the latter?

This feature alone is important enough to justify a separation of these two species from Vertigo, and to warrant the creation of a subgenus for them, but not alone on the point named; there are other characters also. Before considering these, I will say a few more words concerning the former. The gular lamella is generally larger in *P. venetzii* where its inner end can not be seen from the aperture (figs. 11, 12), than it is in *P. milium*; I found it shorter and a little curved in small specimens of the latter from Cedar Keys, Florida; yet it is doubtless the same thing as in others from Illinois, where it exhibits almost exactly the same size and curvature as in *P. venetzii*. As a proof of the distinct nature of the gular fold, it should be mentioned that in several examples of *P. milium* not fully mature, it has been found

well formed, high and thin and ending abruptly, when of the primary D to be connected with it there was not yet a trace to be seen.

The second distinguishing feature is the conformation of the last whorl; it is considerably narrowed toward the aperture, so that the whole shell diminishes at both extremities (hence the name of *angustior* Jeffr.). A deep impression near the base towards the aperture, corresponding to the upper primary, going through the crest to the very margin, adds to the peculiar character of the shell in both species.

Another highly important point is the shape and oblique direction of the columellar tooth (figs. 10, 11), again simulating *Clausilia* and not encircling the pillar as in most of the other groups of *Pupa*. I believe that if the size of our species was ten times what it is, their relation to *Clausilia* would have been remarked ere this.

To these characteristics may be added another; the lower primary lamella D in the peristome is much smaller than the upper, E, whether isolated or united with the gular. In *venetzii* it is very small, while in all Vertigos it is at least as large as E and very often a trifle larger, and is present in species having no upper E, or only a trace of it.

To briefly recapitulate the main distinguishing features of our group, they are, (1) the narrowed ultimate whorl, with deep constriction; (2) the long gular lamella, connected with one of the outer primary teeth; (3) the position of the columellar lamella along the pillar; (4) the small lamella D on the peristome. These characteristics separate our species widely from Vertigo, and require for them a distinct group; they must be considered as constituting a subgenus, as valid and well characterized as any other. I suggest for it the name of *Angustula*, referring to the narrower whorl, and at the same time recalling Jeffrey's name *angustior* for *P. venetzii* Charpentier. That one of the two is dextral, the other sinistral, is no reason against uniting them in one group. It is not without interest to note the fact that one inhabits the Old World and the other the New, in which there are found so few typically sinistral land-pulmonates. One is nearly like the mirror image of the other, yet there are a number of differences between them which may be presented as follows:

P. milium Gld.	*P. vertigo* Charp.
— dextral.	— sinistral.
— finely striated.	— strongly striated.
— gular lamella united with the lower primary D.	— gular lamella united with the upper primary E.
— basal fold C long, lamella-like.	— the basal C short, nodule-like.
— a small but distinct lamella on the peristome above E.	— without the lamella.
— without the nodule.	— a small nodule on body-whorl at the upper angle connected with the lamellar accessory.

P. pusilla Mueller does not differ essentially from the species of *Vertigo* except in being sinistral, and so it simply keeps its place among them.

The following figures from the work of Mr. W. G. Binney may be of use to collectors, though better ones, it is hoped, will in future be supplied in a more extended discussion of the *Pupidæ:*

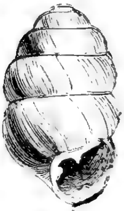


FIG.

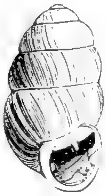


FIG. 2.

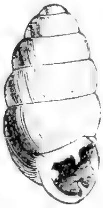


FIG. 3.

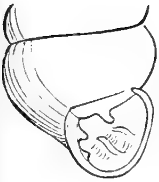


FIG. 5.

FIG. 5a.

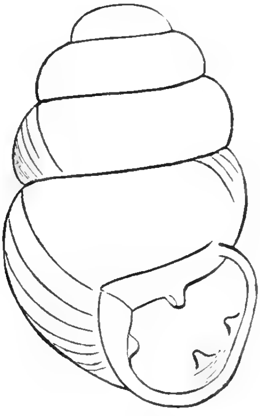


FIG. 4.

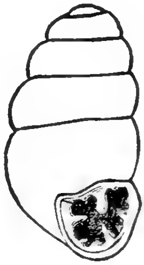


FIG. 6.

Fig. 1. *Vertigo gouldii.*
Fig. 2. *Vertigo californica.*
Fig. 3. *Vertigo rowellii.*
Fig. 4. *Vertigo corpulenta.*
Fig. 5. *Vertigo bollesiana,* last whorl enlarged.
Fig. 5a. *Vertigo bollesiana.*
Fig. 6. *Vertigo floridana.*

Lastly, I venture to add the request that specimens of *Pupa* may be forwarded to me. I shall be obliged for any and everything in this line, even if sent for examination and determination only; in the latter case, the specimens will be promptly returned. The locality and sender will in descriptions be conscientiously acknowledged in every instance.

EXPLANATION TO PLATE XLII.

Diagrams exhibiting the arrangement of the lamellæ of the aperture in Vertigo:

Fig. 1. Outline of the aperture and teeth of *Vertigo antivertigo* Draparnaud; European.
Fig. 2. Aperture of *Vertigo pentodon* Say; American.
Fig. 3. Aperture of *Vertigo gouldii* Binney; American.

Fig. 4. Aperture of *Vertigo tridentata* Wolf; showing a trace of the primary lamella E.

Fig. 5. Diagram of the aperture of *Vertigo ovata* Say; showing primary lamellæ, designated by letters, A on the body, B on the pillar, C at the base of the pillar, D and E on the outer lip. Also the secondary or accessory lamellæ designated by figures 1, 1a, and 2, on the body; 3, 4, 5, and 6 on the outer lip. There are sometimes two secondary denticles between C and D.

Fig. 6. *Vertigo ovata* Say, profile.

Fig. 7. *Vertigo ovata* Say; view of the base; the dotted lines opposite × represent the undulations shown by a section of the last whorl.

Fig. 8. *Vertigo alpestris* Alder; European. Base as in Fig. 7.

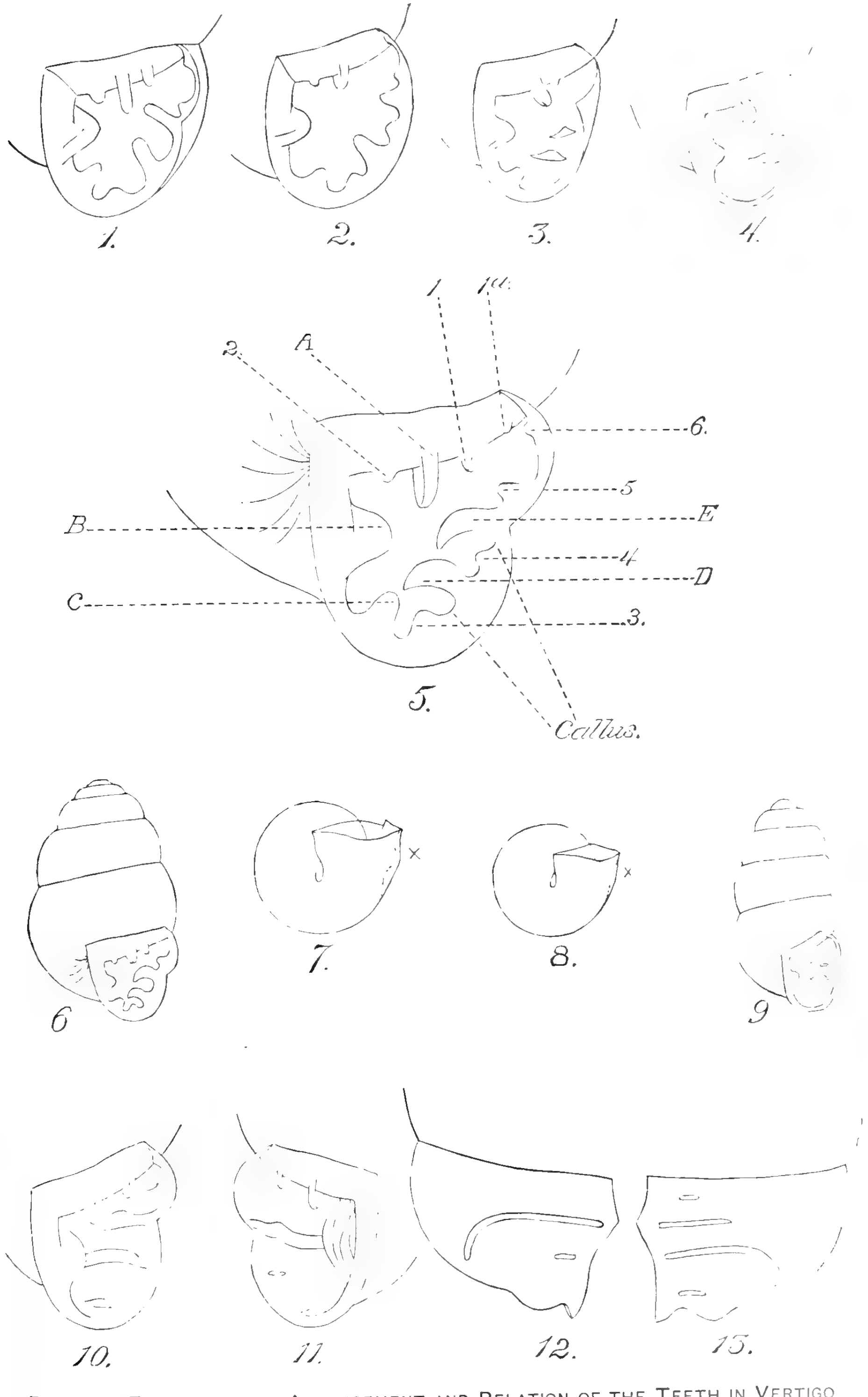
Fig. 9. *Vertigo alpestris* Alder, in profile.

Fig. 10. *Angustula milium* Gould; outline of the aperture showing the lamellæ.

Fig. 11. *Angustula venetzii* Charpentier; diagram of the aperture showing the lamellæ.

Fig. 12. The same, showing the position of the lamellæ as seen through the shell on the left side.

Fig. 13. *Angustula milium* Gould diagram showing the lamellæ, as seen through the shell from the right side, for comparison with figure 12.



DIAGRAMS EXHIBITING THE ARRANGEMENT AND RELATION OF THE TEETH IN VERTIGO

FIG 1. *Vertigo antivertigo* Drap.
FIG. 2. *V. pentodon* Say.
FIG. 3. *V. gouldii* Binney.
FIG. 4. *V. tridentata* Wolf.
FIGS. 5-7. *V. ovata* Say.
FIGS. 8, 9. *V. alpestris* Alder.
FIGS. 10, 13. *Angustula milium* Gould.
FIGS. 11, 12. *Angustula venetzii* Charp.

(Explanation of plate on pages 379-380.)

ON THE SNAKES OF FLORIDA.

BY E. D. COPE.

(With Plate XXXVI, Figs. 3, 4.)

Recent explorations have brought to light a good many additions to the snake fauna of Florida, and the present opportunity is taken for the purpose of making them known, as well as of discussing the nomenclature of some of the species already known.*

Tantilla coronata B. & G. The most eastern locality for this species is Volusia, on Lake George.

Contia pygæa Cope. Known from but two localities, Volusia and Gainesville (Garman).

Osceola elapsoidea Holbr. Not uncommon throughout the State.

Cemophora coccinea Blum. Not uncommon; found as far south as Georgiana County.

Ophibolus doliatus syspilus Cope, subsp. nov.

The brown and red spotted and ringed species of Ophibolus form a continuous series of color modifications, commencing with the spotted *O. d. triangulus* † and terminating with the *O. d. coccineus*, which approaches the *Osceola elapsoidea*. As a whole the *Ophibolus doliatus* L. differs from the other species of the genus in the number of its temporal shields. These are 2 (1)–2–3, while in the others, including *O. rhombomaculatus* ‡ and *O. calligaster*, exhibit 2–3–4, with occasional irregularities.

The *O. triangulum* and *O. coccineus* have been always regarded as distinct species; and so numerous are their differential characters, in coloration, size, and squamation, that this view would seem to rest on a satisfactory foundation. I find, however, that individuals exist which represent every stage of development of each character which distinguishes them, although certain types appear to be more abundant than the intermediate ones. *O. triangulum* is a species of larger size, with two anterior temporals, a row of large dorsal spots, and other smaller ones on the sides, on a grayish ground; with a chevron, and often other marks on the top of the head, and a band posterior to the eye. *O. coccineus* is a small snake with a small loreal plate and one anterior temporal; color red, with pairs of black rings extending around the body, and no markings on the head excepting that the anterior ring of the anterior pair crosses the posterior edge of the occipital shields, forming

* A list of the species of cold-blooded vertebrata of Volusia, Florida, is given in the Proceed. Amer. Philosoph. Soc., 1877, p. 64.

† As pointed out in the preface to the Check-List of the Batrachia and Reptilia of North America, Bull. U. S. Nat. Mus., I, p. 1.

‡ This species is not rare in Virginia, two specimens having been taken in the neighborhood of Alexandria, one by Dr. A. K. Fisher, of the Agricultural Department.

a half collar. The transition is accomplished thus : The lateral borders of the dorsal spots of *O. triangulum* break up, and the lateral spots become attached to their anterior and posterior dark borders. The chevron of the top of the head first breaks into spots, and then its posterior portions unite with each other. The borders of the old dorsal spots continue to the abdomen, where the remaining lateral portions finally meet on the middle line, forming a black line. This breaks up and disappears, leaving the annuli open ; and these are then completed in many specimens. The general colors become more brilliant and the size smaller. The head is more depressed; in immediate relation to this form, the loreal plate is reduced in size, and the two temporal shields of *O. triangulum* are reduced to one. Every form of combination of these characters can be found, which represents six species of the books (in North America), viz: *O. triangulum*, *O. doliatus*, *O. annulatus*, *O. gentilis*, *O. amaurus*, and *O. coccineus*. The oldest name is the *O. doliatus* Linn. Another series of specimens resemble very closely those of the subspecies *coccineus ;* in fact, are identical with them in color. The loreal shield is, however, extinguished, and the rows of scales are reduced by one on each side. These specimens simply carry one degree further the modifications already described. Yet, on account of the constancy of these characters, I am compelled to regard these individuals not only as a distinct species, but, on account of the absence of the loreal plate, as belonging to another genus. This is the *Calamaria elapsoidea* of Holbrook; the *Osceola elapsoidea* of Baird and Girard. It affords an illustration of the principle, which I have elsewhere insisted on, " that adjacent species of allied genera may be more alike than remote species of identical generic characters," which indicates that generic characters originate independently of the specific.

The transitions above noted are not, however, without mutual correlations. The characters are found so associated in such a great majority of the specimens as to indicate the existence of subspecies, whose definitions are given below; exceptions to these are given under the head of each subspecies.

I. No yellow band posteriorly from orbit (a yellow half collar).

α. Dorsal spots or saddles (red) open at the sides, their adjacent borders forming pairs of black rings.

Interspaces between red saddles, open below ; scales not black tipped ; front black: first black ring on nape only .... *O. d. coccineus.*

Interspaces between red saddles closed by black spots below ; scales black tipped ; front black ; first black ring complete .... *O. d. polyzonus.*

Interspaces not closed ; rings, including first, complete on belly ; first yellow band crossing occipital plates; front black; scales not black tipped .... *O. d. occipitalis.*

αα. Dorsal saddle-spots closed at the sides.

β. Saddles closed by a single black tract on the middle of the belly ; no spots between saddles.

Dorsal spots not divided medially ; front black ; first black ring complete .... *O. d. annulatus.*

Dorsal spots divided longitudinally by a median black connection; front black .... *O. d. gentilis.*

ββ. Lateral borders of saddles not confluent with each other below.

Saddles completed on gastrosteges; no alternating spots; no black collar .... *O. d. parallelus.*

Saddles completed on gastrosteges; spots opposite intervals forming a single series on the middle line of the belly .... *O. d. syspilus.*

Saddles completed above the gastrosteges; alternating spots which do not meet on the middle line of the belly .... *O. d. doliatus.*

II. A yellow band from orbit, bounded below by a black or brown one. (Saddle spots closed laterally above gastrosteges; superciliary light spots or bands.)

A half collar touching occipital plates; no neck bands; alternate spots largely on gastrosteges .... *O. d. collaris.*

Neck with longitudinal bands; alternate spots on gastrosteges .... *O. d. clericus.*

Neck with bands; alternate spots entirely on scales .... *O. d. triangulus.*

The more detailed transition from the simple head coloration of the *O. d. coccineus* to the complex pattern of the *O. d. triangulum* is accomplished as follows:

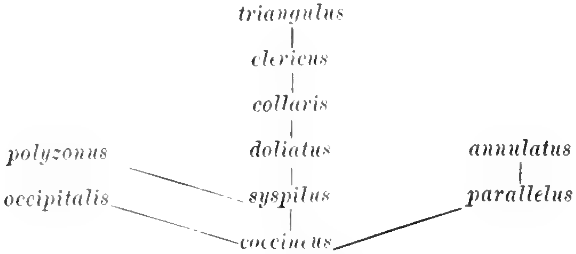
A yellowish spot is seen on the superciliary plate of the single specimen of the *O. d. parallelus* known, and on three of the fifteen specimens of the *O. d. syspilus.* It appears in all of the thirteen *O. d. doliatus*, and in two of these they nearly join across the front, and in three they join, forming a cross-band. In four specimens of the *O. d. doliatus* a notch of the black anterior border of the nuchal collar appears on each side. The deepening of this notch till it reaches the eye defines the two postocular stripes of the subspecies of section II of the preceding table. It has not quite reached the orbit in Nos. 7849 and 2192 of *O. d. collaris.* The superciliary spots have not united across the front in any of the five specimens of *O. d. collaris*, excepting in No. 5449. In No. 2433 it is nearly completed. The interorbital and postorbital bands are complete in the subspecies *O. d. clericus* and *O. d. triangulus.* Finally, the completion of the head ornamentation is seen in the perfect definition of the anterior boundary of the brown band in front of the interorbital light band. This is seen in three individuals of the *O. d. clericus* and in three of the five *O. d. triangulus.* In one of the latter it is simply indistinct; in another it is converted into a median spot by a yellow band, which extends from the interorbital band round the canthus rostralis and end of muzzle.

This species furnishes, then, a most instructive illustration of the origin of color character.

The geographical distribution of the *Ophibolus doliatus* extends from latitude 48° through the eastern Austroriparian and southern part of the central district, and throughout Mexico and Central America to Panama. It is wanting from the Pacific and from the Sonoran districts. It does not appear on the west coast of Mexico north of Colima and Michoacan.

The phylogenetic relations of these subspecies may be sketched as follows. Which is the ancestral form is uncertain; but as the region

inhabited by the *O. d. triangulus* is much older geologically than that where the *O. d. coccineus* is found, the former is probably the primitive type.



The geographical distribution of the subspecies is related to their characters. *O. d. coccineus* is exclusively a form of the Gulf border, and the *O. d. triangulus* is northern, and is not known from south of Washington, D.C. The other forms in the same series occupy the intermediate latitudes. The *polyzonus*, *occipitalis*, and *annulatus* are Mexican, and the *O. d. parallelus* is Floridan. The color increases in brilliancy to the south, as the *O. d. triangulus* is brown-spotted, and the *O. d. coccineus* crimson. The size diminishes in general in the same direction, the species recovering its size in Mexico.

The characters of the *Ophibolus doliatus syspilus* are as follows:

Head small, flattened above, with the snout rounded; neck slightly contracted; body elongated, rather slender; scarlet above, and marked with black rings in pairs; between each pair is a white ring.

The head is rather small, flattened above, with the snout rounded; the vertical plate is pentagonal, with an acute angle behind; the superior orbitals are oblong quadrilateral, broadest behind, and not projecting over the eye; the occipitals are polygonal and very large; the frontal is broad and pentagonal, narrowest externally, where it descends to join an elongate quadrilateral loreal plate. The anterior frontals are also quadrilateral, smaller than the posterior, and broadest externally. The rostral plate is large, heptagonal, and concave below. There are two nasal plates, the posterior square, the anterior emarginated behind for the nostril, which does not enter the posterior, but comes out at its anterior border. There is a single anterior orbital plate, oblong, slightly concave behind, and two small, subround, posterior orbitals. The inferior wall of the orbit is made up of the third and fourth superior labial plates, of which there are seven.

The nostrils are lateral, and near the snout. The eyes are small, the iris bright reddish-gray. The neck is but slightly contracted, and is covered with small, smooth, subhexagonal scales. The body is long, tolerably stout, and covered above with scales similar to those of the neck, but larger. The tail is rather short, thick at its root, but soon becomes smaller, and terminates in an acute tip.

The anterior top of the head is crossed with a black band at the extremities of the occipitals, and the dark color may extend as far as the

prefrontal plates inclusive. The body is scarlet, banded with twenty-two pairs of jet black rings, with a white ring between each pair of black. These rings do not completely surround the body, as in *Osceola elapsoidea*, but the lower part of the anterior ring of one pair is continued within the margin of the gastrosteges, with the posterior ring of another pair; but always at a considerable distance on each side of the middle line.

The belly is marked with a single series of median black spots, which are opposite the spaces between the dorsal saddles, or opposite the yellow rings. These spots represent the confluent lateral spots of the *O. d. doliatus*, *clericus*, etc., as shown in the analytical table of the subspecies. Their complete fusion with the black rings, and the obliteration of the lateral crossing lines of the saddle spots, would give us the *O. d. annulatus*. The division of these median spots on the middle line, and their transposition to the sides, with the elevation of the lateral closing lines of the saddles to a point above the gastrosteges, would give us the *O. d. doliatus*.

This subspecies has not been previously recognized, but its validity is well sustained by fifteen specimens in the U. S. National Museum.

Three or four partly distinct types of head coloration are among these specimens. In 13008, 12925, and 8345 the front is black to the end of the muzzles. In 1846, 2296, and 4291 the end of the muzzle only is red. In 303 and 7850 the top of the head is reddish brown, and superciliary spots are present; and in 13361, 13380, and an unnumbered specimen the top of the head is a uniform red or reddish-gray.

4291: scales 21, 7: scuta 210 + 1 + 44: total length 692, tail 95^{mm}.

13380: scales 21, 7: scuta 209 + 1 + 48: total length 762, tail 115^{mm}. (Type.)

Ophibolus doliatus syspilus Cope.

4291	1	Republican River, Kansas	Dr. W. A. Hammond, U. S. Army	Alcoholic.
1846	2	Fort Towson, Ark.	Dr. L. A. Edwards, U. S. Army	Do.
2296	1	Prairie Mer Rouge, La	James Fairie	Do.
13008	1	New Orleans, La	Dr. R. W. Shufeldt, U. S. Army	Do.
12925	1	do	do	Do.
13045	1	do	do	Do.
12297	3	Georgiana, Fla	G. Wittefield	Do.
8435	1	Apache, Ariz	H. W. Henshaw	Do.
5188	1	Louisiana	J. W. Wallace	Do.
303	1	Independence, Mo	Dr. J. G. Cooper	Do.
7650	1	Abbeville, S. C		Do.
13361	1	Wheatland, Ind	Robert Ridgway	Do.
13380	1	Richland, Ill	do	Alcoholic (type).

A specimen is in my private collection from Fort Harker, Kans.

Ophibolus doliatus parallelus, subsp. nov.

Scales in twenty-one rows, rather short and wide. Head distinct, muzzle not prominent. Rostral plate very little visible from above. Muzzle short. Frontal wide; occipital nearly as long as frontal and prefrontals. Loreal well developed, longer than high; oculars 1–2; temporals 2–2–3. The seven superior labials are all higher than long; the

July 5, 1889.

third and fourth bounding orbit. Postgeneials half as long as pregeneials.

Back crossed by saddles of brownish-red (in alcohol), with black borders, which extend to the gastrosteges, and thus close the saddles by the longitudinal direction of the black border. These borders of opposite sides form parallel longitudinal black lines. The saddles are long, covering on an average nine scales. There are twenty of them in front of the anus in the type specimen. They are separated by yellow intervals of one and a half scales in width. There are no lateral or ventral spots opposite to these, alternating with the principal ones. The ground color below is yellowish. The top of the head is reddish-brown, bounded posteriorly by black, which crosses the posterior border of the occipital scuta. This is followed by a yellow half collar, which is followed by the black anterior border of the first dorsal saddle, and which turns backwards along the ends of the gastrosteges like the others; a yellowish-black edged spot on each superciliary plate and a similar one on the canthus rostralis, which sends a short branch along the anterior border of the frontal. Superior parts of superior labials black, inferior parts yellow.

10544: 21, 7: 210 + 1 + 146: 325, 42.

This subspecies occupies an interesting intermediate position between *O. d. annulatus* and *O. d. syspilus*. It differs from the former in the fusion of the lateral saddle-borders and the absence of a black collar; from the latter in the absence of intermediate spots on the middle of the belly and the close approximations of the borders of the saddles.

Ophibolus doliatus parallelus Cope.

10544	1	Gainesville, Fla	James Bell	Alcoholic.

Ophibolus getulus getulus L.

Specimens of this species from Florida have the scales in twenty-three longitudinal rows instead of in twenty-one, the normal number for the species. In this respect they agree with the *O. g. boylii* of the Pacific district.

Dromicus flavilatus Cope.

Besides the specimens I have noted from Volusia, the National Museum has received four from G. Wittefield, Georgiana, in southeast Florida, and Mr. S. W. Garman reports it from another locality.

Coluber obsoletus lemniscatus, subsp. nov.

This snake differs from the typical *C. o. obsoletus* in the distinctness of the color pattern, which shows the lateral spots confluent into a broad band which extends from the neck to the end of the tail. The dorsal spots are distinct, and the angles of the anterior are continued as two parallel nuchal bands to the parietal scuta. Below clouded, but not spotted. No head bands. Several rows of dorsal scales keeled.

This form is intermediate between the *C. quadrivittatus* and the *C. obsoletus*. The lateral band is much wider than that of the former species. A specimen was sent me from Mobile, Ala., by Dr. Joseph Corson, U. S. Army, and it is therefore probably found in Florida, though it has not yet been actually obtained there. A second specimen is in the National Museum from Whitfield County, in northern Georgia. Two other specimens—one from Mobile and one from Georgia—show the lateral bands interrupted into spots posteriorly, and hence connect with the *C. o. spiloides*, D. & B. (*C. o. confinis*, B. & G. Cope., *olim*).

Coluber quadrivittatus Daudin. Common over the State.

A series of twenty young of different ages from Georgiana show that they are all spotted, and considerably resemble the *C. o. spiloides* in the early stages, and that the lateral spots become first confluent into bands, and later the angles of the dorsal spots are produced so as to form the two dorsal stripes. Later the dorsal spots disappear in most specimens; in a few individuals they remain. In the young the spots are considerably more numerous than in the *C. o. spiloides*.

Coluber guttatus guttatus L. From Arlington, Fla., G. B. Goode, of the typical form and coloration.

Coluber guttatus sellatus, subsp. nov.

This subspecies does not differ in any structural character from the typical *C. guttatus guttatus*, excepting that the scales are in twenty-nine instead of twenty-seven longitudinal rows. The value of this point is uncertain, as but two specimens are known. The essential differences are seen in the color. The head-bands, so conspicuous in the *C. g. guttatus*, are wanting here, except the postocular, which is present, and is black bordered above and below. The parietal band is indicated by a black external border which extends to the edge of the parietal plate. It is further faintly indicated by a shade which joins that of the opposite side on the front of the frontal scute. A second character is seen in the absence of lateral spots on the body, their places being clear pink or yellowish, like the ground of the belly. The spaces between the dorsal spots and those between the lateral clear spaces are gray dusted. The scales at the superior edge of the lateral pale spots are sometimes black bordered, partially outlining a lateral spot. This is most distinct anteriorly, where these borders form interrupted longitudinal lines. The dorsal spots are red and have narrow serrate black anterior and posterior borders. The spots are wider than in the *C. g. guttatus*, covering nineteen and twenty-one longitudinal rows of scales, while in the former they cover but from ten to fifteen rows of scales. The belly is tessellated with black spots, as in *C. g. guttatus*, each spot covering the external half of two or three gastrosteges. A delicate black line connects them externally, running along the angle of the gastrosteges.

9692: 237 + 1 - 64: 29: 918, 173.

6507: 234 + 1 - 65: 29.

This subspecies inhabits Florida along with the typical one, which

displays its full characters in the same region. The *C. g. sellatus* is evidently annectant to the *C. rosaceus* of southern Florida.

9692	1	Arlington, Fla	G. Brown Goode	Alcoholic.
6567	1	Palatka, Fla	Dr. T. H. Bean	Do.

Coluber rosaceus, sp. nov. (Plate XXXVI, Fig. 3.)

Head oval, distinct from body. Rostral plate visible from above; internasals much shorter than prefrontals. Frontal wider than in allied species, as broad as it is long, with straight anterior border. Parietals longer than muzzle from frontal plate. Loreal longer than high; preocular not reaching frontal, but separated by the very narrow anterior extremity of the superciliary. Temporals 2–3–4, the posterior small. Scales of body smooth, rather wide, the first row a little wider than the second. Postgeneials smaller than pregeneials, but distinct from gular scales. Gastrosteges bent up at the sides. Tail probably long, as in *C. quadrivittatus*, but the end is lost. The urosteges remaining number 47.

The ground color of the superior surfaces, in the rather fresh alcoholic specimen, is buff, each scale with a dusky band within and parallel to the border, surrounding a buff center. This band may be broken up into spots. The greater part of the superior surfaces is occupied by a series of vermilion-tinted pink spots, which extend across the back to within two and three scales of the gastrosteges, thus covering from twenty-one to twenty-three scales transversely. Their length covers six scales everywhere, though as the scales are more elongate anteriorly the spots are also more elongate. The lateral spots of other species are here represented by pale tracts continuous with the light yellow of the belly, which alternate with the dorsal spots, extending to an apex on the fourth and fifth row. In other words, the cross-bands of dusky ground color bifurcate on the flanks, and terminate at the extremities of the gastrosteges. Below their termini, at the lateral angle of the gastrosteges, is a short longitudinal black bar or spot crossing one or two gastrosteges. This represents the black line which occupies a similar position in the *C. guttatus*. At the anterior and posterior parts of the body the dorsal spots have short serrate anterior and posterior borders. Four indistinct longitudinal bands traverse the length of the body, on the fourth and fifth and tenth and eleventh rows of scales on each side. The inferior band is very obscure, especially anteriorly, and both are less distinct on the true skin than on the epidermis.

The head is of a reddish color above; below yellowish. A faint dusky band extends across the temporal region and parts of the superciliary and frontal plates, meeting a corresponding one of the opposite side. This represents the space between the bands of the *C. guttatus*, which consists in this species of ground color only. Superior and posterior margin of the upper labials obscurely dusky.

14418 : 239 – 2 : 27 : 970 ?

This beautiful species is of considerable interest from the intermediate position it occupies between the *C. guttatus* and the *C. quadrivittatus.* The absence of keels of the scales and the dorsal color spots ally it to the former, and especially to the subspecies *C. g. sellatus;* but the absence of lateral and ventral spots and head-bands and presence of longitudinal stripes ally it to the latter. The width of the frontal plate is also characteristic. It is a very handsome animal.

Coluber rosaceus Cope.

Catalogue number.	Locality.	From whom received.	No. of specimens.
14418	Key West, Fla	Henry Hemphill	1

The proper application of the Linnæan generic name Coluber only appears after considerable criticism of the work of the earlier writers on reptiles. The first author to use the name after Linnæus was Laurenti, in 1768, in his Specimen Synopsis Reptilium, published at Vienna. He includes in it ten species, of which eight can be determined. Of these three are Viperidæ, one is a crotalid, and four are harmless snakes. All of the venomous and three of the harmless species bear Linnæan names, and all of them are members of the Linnæan genus Coluber. It remains to be determined for which of these types the name Coluber of Laurenti must be retained. The evidence is furnished by the author in the following foot-note attached to the generic character:

Colubri venenati absque ulla injuria accepta ferocissima irruunt in hominem.

In the opinion of Laurenti the Colubri were poisonous, and this was probably due to the fact that the only species of his list with which he was acquainted by actual observation were the European vipers he included in it. The poisonous species are then the types of the Coluber of Laurenti.

The next author to use the name Coluber was Treviranus in his Biologie ad Philosophie d. natur, Göttingen, 1802. He indicated but one species, *C. natrix.* As this species is the type of the Natrix of Laurenti of 1798, it can not be used in that connection.

Oppel, in his work on Reptilia published in 1811, gave the following species under the genus Coluber:

C. melanocephala L.	*C. natrix* L.
C. cursor.	*C. mycterizans* L.
C. æsculapii Gmel., Linn., 1788.	*C. ibiboca.*
C. canus L.	*C. cyaneus* L.
C. viperinus L.	*C. carinatus* L.

Of these species the *C. cursor* and *C. ibiboca* are not Linnæan, and the *C. viperinus* and *C. natrix* belong to a genus which had been already

established, the Natrix of Laurenti. We are therefore restricted to six species in our search for the type of the genus Coluber. They received generic names at the following dates:

C. melanocephala; Tantilla B. & G., 1853.
C. æsculapii; Coluber Günther, 1858.
C. canus; Pseudaspis Cope, 1864.
C. mycterizans; Passerita Gray, 1825.
C. cyaneus; unindentified.
C carinatus; Herpetodyas Boie, 1826.

Günther in 1858 selected the *C. æsculapii* as the type of Coluber, and to this species that generic name must be applied.

Mr. Garman, of Cambridge. has followed Duméril in using the name Coluber for the *C. constrictor* Linn. The way in which this conclusion has been reached is as follows:

The first author whom we have to consider is Fitzinger, whose Neue Classification der Reptilien appeared in June, 1826, in Vienna. Seventy-one species of Coluber are enumerated in this work (p. 57), of which only twenty-two are of Linnæan origin, and to these we must therefore confine our attention. In the following list of them the names of the genera to which these species were successively referred is given, and the date of each:

C. minerva (unidentified).
C. typhlus, Opheomorphus Cope, 1862; Xenodon Boie & Schleg., 1837.
C. cyaneus L. (unidentified).
C. constrictor, Bascanium Bd. & Gird., 1853.
C. saturninus, Herpetodyas Boie, 1826.
C. reginæ, Liophis Wagl., 1830.
C. miliaris (unidentified).
C. cobella, Opheomorphus Cope, 1862; Liophis Wagl., 1830.
C. rhombeatus, Psammophylax Wagl., 1830.
C. domesticus, the same as
C. hippocrepis, Zamenis Wagl., 1830.
C. lineatus, Lygophis Cope 1862: Dromicus Bibr., 1853.
C. pethola, Oxyrrhopus Wagl., 1830.
C. vittatus, Tropidonotus Kuhl, 1826.
C. æstivus, Herpetodyas Wagl.: Dum. & Bibr., 1853.
C. scaber, Dasypeltis Wagl., 1830.
C. ordinatus, Eutænia Bd. & Gird., 1853; Tropidonotus Kuhl, 1826.
C. striatulus, Haldea Bd. & Gird., 1853.
C. natrix, Tropidonotus Kuhl, 1826.
C. stolatus, Amphiesma Dum. 1853: Tropidonotus Kuhl, 1826.
C. saurita, Eutænia Bd. & Gird., 1853; Tropidonotus Kuhl, 1826.
C. fasciatus, Tropidonotus Kuhl, 1826.

The latest date only can be considered in this connection, since the names of genera are retained in accordance with the priority of date of each. The latest date at which species of this restricted division Coluber are referred to other genera is 1853. In that year four of them were referred to genera distinct from Coluber, and of these genera three were newly established. These three are Bascanium B. & G., Drom-

icus Bibron, and Haldea B. & G. Now Duméril, who published the prodromous of his classification of the serpents in 1853, expressly retains the name Coluber for the *C. constrictor* of Linnæus, type of Bascanium. But as the *C. constrictor* is not included in the Oppelian genus Coluber of 1811, it can not be considered here at all.

Shortly after the appearance of the work of Fitzinger, Boie furnished a synopsis of his systematic work on Reptiles to the Bulletin des Sciences Naturelles, edited by Férussac, 1826, IX, page 237. He gives a list of thirty-five species of the genus Coluber, of which only six are Linnæan. Of these but three appear in the list from Fitzinger, given above. These are *C. cyaneus*, *C. hippocrepis*, and *C. constrictor*, thus restricting the name to the *C. constrictor*.

Soon after, however, Boie gave a list of the genera of snakes, with a typical species for each, in the Isis von Oken, 1827, page 982. Here he cites the *C. elaphis* (*Elaphis quaterradiatus* Gem., Dum. & Bibr.) of Europe as the type, and adds "u. v. a," which means, *und viel andere*—species belonging to the genus. What these other species are, may be derived from a perusal of a previous paper by Boie in the same volume, page 209, where he describes three closely allied species from Japan, the whole belonging to the genus Elaphis of Dumèril and Bibron, and one of them (*Coluber conspicillatus*), being a member of the genus Coluber of Günther. Dr. Günther has regarded this reference as an indication of the meaning of Boie in his use of the name Coluber, and this determination must stand on the ground of previous determination by Oppel.

Pitycphis melanoleucus Holbr. Distributed throughout the State.

Spilotes corais erebennus Cope. Volusia.

Cyclophis æstivus L. Generally distributed.

Bascanium constrictor Linn. Volusia and Key West.

Bascanium flagelliforme Catesby. Throughout the State. Georgiana.

Heterodon platyrhinus Latr. Generally distributed.

Heterodon simus. From the northern and western parts of the State.

Storeria occipitomaculata Holbr. Volusia.

Allied to this genus is *Tropidoclonium* Cope, which has the anal shield entire. I have referred to this genus the *Regina kirtlandii* of Kennicott. This species, however, has a divided anal plate, and must be therefore assigned to a distinct genus. This I call *Clonophis*, with the following characters: Teeth equal; anal plate divided; nasal plate partly divided, loreal present; scales keeled. Head not distinct from body.

Allied to this form is the *Virginia inornata* of Garman, from Texas. It agrees with Tropidoclonium except in the absence of preocular plate, the loreal extending to the orbit. It must be referred to a distinct genus, which I call *Amphiardis*, with the following characters: Teeth equal; anal plate entire; nasals two; internasals two; no preocular, its place taken by the loreal; scales keeled. Head not distinct.

The *Tropidoclonium storerioides* Cope, of Mexico, can not be referred to either of the above genera, but agrees with Natrix (Tropidonotus), to which I refer it under the name *Natrix storerioides.*

Natrix taxispilota Holbr. Lake Okeechobee, Heilprin.

Professor Heilprin has referred an individual of this species to a distinct subspecies, under the name of *Tropidonotus taxispilotus brockii*, on account of the subdivision of the parietal shield. This is, however, the normal condition of the species.

Natrix fasciata fasciata Linn. Northern Florida.

The generic name Natrix antedates Tropidonotus of Kuhl. It was proposed by Laurenti in 1789 for a heterogeneous collection of species, but the *N. vulgaris* (*Tropidonotus natrix* Kuhl) was clearly indicated as the type. Kuhl's name dates from 1826.

Natrix fasciata erythrogaster Shaw. Northern Florida.

Natrix usta Cope. **Tropidonatus ustus Cope.**

The typical specimen was taken at Charlotte Harbor. A second was sent to the National Museum from Key West.

Natrix compressicauda walkeri. Yarrow.

Natrix compressicauda compsolæmus Cope.

Natrix compressicauda compressicauda Kenn. Five specimens from Georgiana, and one from another locality.

Natrix compressicauda bivittata, subsp. nov.

Head oval, distinct from neck; tail long, moderately compressed at base; less than in types of species. Rostral plate elevated; internasals longer than wide: frontal elongate and with parallel sides. Loreal oblique, longer than high: oculars 1–3, the inferior posterior not below the orbit, but nearly cutting the fifth superior labial out of its border. Temporals 1–3; superior labials eight, middle of orbit above suture between fourth and fifth. Inferior labials ten; postgeneials longer than pregeneials. Scales of body in twenty-one series, all keeled.

Ground color above light brownish-ash, below light yellow. The former region is crossed in the typical specimen by thirty-six blackish-brown cross-bars, which are wide and close together on the median dorsal region, and tapering and therefore separated on the sides. The dorsal parts of the spots join and form two wide longitudinal bands on the anterior fifth of the length. A pale-brown band passes from the superciliary plate to the side of the neck, leaving a dark postorbital band below. All the plates of the lips and throat are yellow, and have narrow black borders. On the yellow of the belly there are black spots on the gastrosteges, which incline to fuse transversely, leaving a part of the ground visible in the middle. Anteriorly this arrangement assumes the form of two longitudinal black bands, which are well defined on the anterior fourth of the length, leaving a yellow band between and one on the outer side of each of them.

13659: 131 + 1 + 93: 336, 97^{mm}.

The two specimens representing this species are intermediate in characters between the typical *N. compressicauda* and the *N. sipedon fasciata*, but are quite distinct from either. The tail is longer than in any specimens of either. From the *N. c. walkeri* the *N. c. bivittata* differs in a number of minor points. These are the much wider dorsal bands, the postocular band, the distinct black bands of the nape and of the inferior region, and the reduced number of dorsal rows of scales:

13659	1	Georgiana, Fla.	1883	William Wittfield	Alcoholic.
13692	1	do	1883	do	Do.

Eutænia sirtalis Linn. Volusia.

Eutænia sackeni Kennicott.

This species is distributed over Florida generally, and ranges as far westward as Mobile, Ala., from which point specimens were sent me by my friend, Dr. Joseph Corson, U. S. Army. It is the most slender species of the genus, and is characterized by the form of the first row of scales. These are narrow, differing very little from those of the other rows. Like them they are strongly keeled, and are notched at the apex. The form originally described has no dorsal stripe. Specimens of this kind were sent me from Volusia. Specimens from Georgiana, belonging to the National Museum, and from Mobile, have a dorsal stripe with blackish borders. Two Volusia specimens have seven superior labials, while one has eight. Two specimens from Mobile have eight superior labials, and four from Georgiana have the same. In one of the latter the colors, including the stripes, are obscure.

Liodytes alleni Garman. *Helicops alleni* Garman; *Liodytes* Cope. Not uncommon throughout the peninsula.

Ancistrodon piscivorus L. Generally distributed.

Crotalophorus miliarius L. Generally distributed.

Crotalus adamanteus adamanteus Beauv. Found everywhere.

The largest specimen in the National Museum measures 6 feet in length. Holbrook writes of specimens of 8 feet, and Admiral McCauley informs me that he has seen specimens of that size on the islands off Pensacola. This species is, then, the largest of the venomous snakes of the Western Hemisphere, and only exceeded in length by two or three of the larger Najidæ of the Old World, which are, however, of much more slender form.

GENERAL REMARKS.

Of the species and subspecies above described, there are peculiar to Florida the following:

Contia pygæa Cope.
Ophibolus doliatus parallelus Cope.
Coluber guttatus sellatus Cope.
Coluber rosaceus Cope.
Natrix usta Cope.
Natrix compressicauda compsolæma Cope.
Natrix compressicauda walkeri Yarrow.
Natrix compressicauda compressicauda Kenn.
Natrix compressicauda bivittata Cope.
Eutænia sackeni Kenn. (Ranges to Mobile.)
Liodytes alleni Garman.

In all, six species and six subspecies. Of these but one represents a genus which has not yet been found out of the peninsula. The total number of species and subspecies included in the list is thirty-five. Of these only six are not confined to the Austroriparian region; as follows:

Ophibolus getulus getulus L.
Pityophis melanoleucus Holbr.
Coluber constrictor L.
Heterodon platyrhinus Latr.
Storeria occipitomaculata Holbr.
Eutænia sirtalis L.

All of these are distributed throughout the eastern region, and the *Coluber constrictor* and *Eutænia sirtalis* throughout the central region as well.

CATALOGUE OF BATRACHIA AND REPTILIA BROUGHT BY WILLIAM TAYLOR FROM SAN DIEGO, TEX.

BY E. D. COPE.

(With Plate XXXVI, Fig. 2.)

San Diego is a town situated in Nueces County, southwestern Texas, on the San Diego Creek, which is a tributary of the Nueces River. It is distant about 50 miles northwest of Corpus Christi, which is on the Gulf of Mexico. The present list includes forty-two species, which is an indication of considerable wealth in the forms of life above referred to. In a previous essay "On the Zoological Position of Texas"* I have enumerated the Batrachia and Reptilia known from the State. Species additional to that list are mentioned at the end of this one.

BATRACHIA.

TRACHYSTOMATA.

Siren lacertina L. Common.

URODELA.

Diemyctylus viridescens meridionalis Cope, Bull. U. S. Nat. Mus., No. 20, p. 30. *D. meridionalis* Boulenger Ann. Mag. Nat. Hist., 1888, p. 24. Ten specimens.

SALIENTIA.

Bufo punctatus Bd. & Gird. Two specimens.

Bufo insidior Gird. Two specimens.

Bufo valliceps Wiegm. Four specimens.

Hypopachus cuneus, sp. nov.

The genus *Hypopachus* (Keferstein) was described as follows: Göttingen Nachrichten, 1867, p. 352; Boulenger, Cat. Batr. Sal. Brit. Mus., Ed. II, 1882, p. 159. It is thus defined: No frontoparietal fontanelle. Frontoparietal and frontal bones in contact, concealing the ethmoid. No omosternum. No dermoossifications. Terminal phalanges simple. No vomerine teeth. Tongue simple, oval.

Three species of this genus are known, the *H. oxyrrhinus* Boul. and the *H. variolosus* Cope, which, with its subspecies *inguinalis* Cope, ranges from Costa Rica to Guatemala on the east and Michoacan on the west. The three species differ as follows:

Head one-sixth total length; toes with as hort web; no lateral band .... *H. variolosus*
Head one-eighth total length; toes without trace of web; heel to humerus; no lateral band .... *H. cuneus*
"Toes with a slight web; heel to end of muzzle; a blackish lateral band". *H. oxyrrhinus*

* Bull. U. S. Nat. Mus., 1875, No. 20.

The *H. cuneus* has the following characters:

Head small. Body large. Limbs short. Muzzle scarcely longer than diameter of eye, projecting a little beyond mouth border. A dermal groove across head at posterior borders of eyelids, and one from below posterior canthus of eye to shoulder. Another across the thorax from the inferior origin of one humerus to the other. Skin everywhere smooth. Tympanic drum invisible. When the anterior limb is extended the end of the fore-arm reaches the end of the muzzle. The distal end of the tarsus reaches the anterior base of the humerus, and the end of the second toe reaches the end of the muzzle when the hind limb is extended. The third finger is rather elongate, and the lengths of the fingers are in order, beginning with the shortest, 1–2–4–3, the second and fourth being equal. In the posterior foot the lengths are, beginning with the shortest, 1–2–5–3–4, the second and fifth being about equal, and the third a good deal shorter than the fourth. The palmar tubercles are not very distinct. At the distal end of the tarsus there are two large subequal sharp-edged tuberosities. The edge of the internal is oblique, that of the external transverse. Distinct small tubercles under the articulations of the phalanges. The femur is almost entirely inclosed in the integument of the body.

The tongue is large, and forms an elongate flat ellipse. The internal nostrils are anterior, and are a little farther apart than the external nostrils. The latter are nearly terminal in position.

The color is light brown, or grayish-brown, sometimes tinged with olive, and there is generally a pale median vertebral line. There is a wide band on each side of a paler tint, extending from the orbit to near the groin. It is sometimes only indicated by a line of black specks, forming a border above and below. A pale line from eye to front of humerus. Numerous rather large black spots on the groin, and numerous smaller ones on the posterior face of the femur, between which the color is often dark red. Small black spots on posterior faces of tibia and astragalus, anterior edge of tibia, and posterior edge of humerus. Digits with a light spot at each phalangeal articulation. Belly yellowish, with or without a faint coarse reticulation of a darker color.

Measurements.	Meters.	Measurements.	Meters.
Length of head and body	.041	Length of hind limb from anus	.046
Length of head to rictus oris	.006	Length of hind foot	.023
Length to axilla, axially	.015	Width of head at rictus oris	.010
Length of fore limb from front	.022	Width of extended femora	.031
Length of fore foot	.0095		

Rather abundant.

Engystoma carolinense Holbr. Three specimens.

Rana virescens Kalm. *R. halecina* "Kalm," Schreber. Three specimens.

REPTILIA.

TESTUDIATA.

Cinosternum flavescens Agass. One specimen.
Pseudemys ornata Gray. Two specimens.
Cistudo ornata Agass. One specimen.
Xerobates berlandieri Agass. One specimen.

LACERTILIA.

Oligosoma laterale Say. Not common; one specimen.
Eumeces obsoletus B. & G. Eight specimens.
Cnemidophorus sexlineatus L. Five specimens.
Cnemidophorus tesselatus. One specimen.
Sceloporus ? scalaris Wiegm. Seven specimens.
Sceloporus variabilis Wiegm. Nine specimens. First found in the United States near Corpus Christi, by Francis Aaron; common in Mexico.
Sceloporus spinosus Wiegm. Four specimens.
Sceloporus sp. Five specimens.
Sceloporus torquatus Green. Six specimens.

Lysoptychus lateralis, gen. et sp. nov. (Plate XXXVI, Fig. 1.)

Char., gen.—Nearly allied to Sceloporus and Uta. A loose fold across the throat formed by the conjunction of the prehumeral folds, as in Ctenosaura, not closely folded nor bordered with enlarged scales. Femoral pores; no preanal pores. No dorsal crest. Tympanic disk exposed.

This genus is intermediate between Sceloporus and Uta. The loose dermal neck-fold, like that of some of the larger genera of Iguanidæ, is not found in the former. The tightly adherent collar of Uta might have been developed from a Sceloporus through a Lysoptychus.

Char., specif.—Integument of side of neck thrown into numerous folds. The most prominent is continuous with the collar fold, and it sends out two folds forwards to the tympanic meatus. A second fold is concentric with the base of the humerus at its anterior base; its superior part is prominent and longitudinal, and continues to the fold in front of it. Tail round.

The scales of the sides are smaller than those of the belly, which are smaller than those of the back. The latter are rather small, counting seventeen longitudinal rows between the small lateral scales of the scapular regions. The keels of the dorsal scales are in parallel lines. Scales of the tail subequal, strongly keeled, except below. Fifteen femoral pores. Two postanal plates.

Interparietal plate large, subround; parietals small, subpyriform, one fifth as large as the interparietal. Five or six transverse supraorbital plates, separated from the frontals by one row and from the superciliaries by two rows of scales. Frontal divided transversely, the anterior part divided longitudinally. These plates are preceded by two plates, and these by three in transverse relation; two large internasals sepa-

rated from the rostral by two small scales. All the scales of the head smooth.

Color above brown, with faint traces of small darker brown spots. Sides blackish, the prominent parts of the folds of the neck paler. Anterior border of meatus auditorius paler. A large blue patch on each side of the belly extending from axilla to groin, and not meeting its fellow on the middle line. Throat yellowish, faintly reticulated with blue. Posterior face of femur with a light band, bordered by dark above and below. A black spot on side over scapula.

Total length, .180^{m}; length to vent, .059; to collar, .015; of anterior leg, .027; of posterior leg, .044; of posterior foot, .021.

This species is about the size of the *Sceloporus consobrinus*. It seems to be rare, as Mr. Taylor took only one specimen.

Holbrookia propinqua B. & G. Two specimens.

Holbrookia texana Trosch. Four specimens.

Crotaphytus collaris Say. One specimen.

Phrynosoma cornutum Harl. Four specimens.

OPHIDIA.

Tantilla gracilis B. & G. Three specimens.

Tantilla nigriceps Kenn. One specimen.

Contia episcopa Kenn. One specimen.

Ophibolus sayi Holbr. Three specimens.

Rhinochilus lecontei B. & G. Two specimens.

Hypsiglena ochrorhynchus Cope. One specimen.

Coluber obsoletus Say. One specimen.

Coluber emoryi B. & G. Five specimens.

Pityophis sayi Schleg. Three specimens.

Spilotes corais erebennus Cope. One specimen.

Cyclophis aestivus L. Three specimens.

Bascanium flagelliforme Catesb. Two specimens.

Heterodon platyrhinus Latr. Two specimens.

Eutænia marciana B. & G. One specimen.

Natrix rhombfera Hallow. One specimen. *Natrix* Laurenti, 1798, and Fleming, 1812, is prior to *Tropidonotus* Kuhl, 1826.

Elaps fulvius L. Two specimens.

Crotalus adamanteus atrox B. & G. Two specimens.

The species new to our fauna are the *Hypopachus cuneus* Cope, *Pseudemys ornata* Gray, and the *Lysoptychus lateralis* Cope.

ON THE EUTÆNIÆ OF SOUTHEASTERN INDIANA.

BY E. D. COPE.

In a collection of snakes sent me by my friend, Mr. A. W. Butler, of Brookville, Ind., specimens of the genus *Eutænia* B. & G. considerably predominate. These include, as is to be supposed, the two usual species, *E. sirtalis* L. and *E. saurita* L. The former is represented by four strongly marked subspecies. Besides these, there are two other distinct species which have not been hitherto observed in Indiana, to one of which it is necessary to give a new specific name. This is unexpected, but shows what can be done by thorough collecting, such as has been undertaken by the members of the Indiana Academy of Sciences. I append a list of the species and subspecies, with descriptions of the novelties:

1. **Eutænia sirtalis sirtalis** Linn. Nos. 318, 359, and 360, typical. No. 275 (two specimens) in their obsolete lateral stripes are intermediate between this and the next subspecies.
2. **Eutænia sirtalis ordinata** L. 292, 314.
3. **Eutænia sirtalis graminea** Cope. Subsp., nov.

This form is a uniform light green above, below yellow clouded with green. Lips, chin, and throat uniform yellow. No stripes or spots on the body, nor markings of any kind on the head. Scales 19 rows; superior labials, 7; temporals, 1–3, first large; gastrosteges, 150; anal, 1; urosteges, 66 pair, four of the latter undivided; lowest row of scales smooth; length, 495^{mm}; tail, 107.

This form is the extreme in the direction taken by the *E. s. ordinata*, where the bands are entirely wanting, but the quadrate lateral spots remain. In the entire absence of black marks on the labial and abdominal plates, this form differs also from its immediate allies. The coloration in that of *Cyclophis æstivus*. One specimen, No. 295.

4. **Eutænia sirtalis obscura** Cope. This form resembles at first sight the *E. saurita*. Nos. 319, 321.
5. **Eutænia butleri**, sp. nov.

Scales in nineteen longitudinal rows, the inferior much the widest and keeled. Superior labials seven. Temporals, 1–1; the second large, extending from parietal to labials. Oculars, 1–3. Parietals with the external border abruptly contracted. Gastrosteges, 144; anal, 1; urosteges, 62. Head very little distinct, muzzle conical, a little protuberant; eye not large. Ground color, above olive brown, which is marked by the usual three longitudinal yellowish bands. The median covers one and two half rows of scales, and the lateral covers the second, third, and fourth rows. Both are black bordered on both edges, the

border of the latter band interrupted. The segments of the superior border of the lateral band represent the inferior spots of the lateral series; the superior row is wanting from the scales. Gastrosteges and urosteges olive, yellowish in front, dark behind, with a vertical black spot at the anterior border of each end of each of the gastrosteges. Labial scuta without black borders; head olive above without markings, except two small, yellow, black-edged parietal spots in the usual position.

There is but one specimen of the species (No. 264), which is labeled as coming from Richmond, Ind. It is remarkably distinct from everything which occurs in the United States, and has only superficial resemblances to the *E. flavilabris* Cope, of Mexico. Its peculiar characters are the great width of the lateral color band, which covers three rows of scales, one more than in any other species; the black borders of the bands; the absence of well-defined dorsal lateral spots, and the absence of markings on the head and labial scuta. Besides these color marks, the presence of a large second temporal plate extending to the labials is peculiar to this species if found constant; and the narrow conical head is characteristic. In the *E. flavilabris* the general appearance is somewhat similar, but the labial plates are broadly black edged, and the lateral band covers but two rows of scales; there is a large postoral yellow dark edged crescent, and the second temporal plate is smaller and does not reach the labials.

It gives me much pleasure to dedicate this handsome species to Mr. Butler, whose interest and labor in the natural sciences have resulted in many interesting discoveries.

6. **Eutænia radix melanotænia** Cope, subsp. nov.

Scales in twenty-one longitudinal rows, the inferior largest and keeled. Superior labials, 7 (8); frontal wide; oculars, 1–3. Parietals long, borders regular. Temporals, 1–2, the second above, moderate. Gastrosteges, 153; anal, 1; urosteges, 68. Head distinct; muzzle short, not protuberant. Lateral stripe on third and fourth rows of scales, not black bordered above or below. Dorsal band on one and two half rows of scales nearly completely black bordered. Between these the dorsal ground color is dark olive-brown, but the space is nearly occupied with the two rows of quadrate black spots. Below the lateral stripe two rows of alternating black spots, one on each row of scales, which sometimes coincide, on an olive-brown ground. Gastrosteges with a black longitudinal spot near the end of each, which is frequently confluent with the adjacent ones, from two to five running together to form an interrupted lateral ventral black stripe. Between these, the gastrosteges are black-edged, except on the anterior fourth of the length. Length, 285^{mm}; tail, 65^{mm}. Anterior dorsal region and top of head nearly black; two parietal spots. Labial plates and chin yellow, the former with broad black posterior edges on the upper lip.

In this species the scuta present no exceptional features, except that

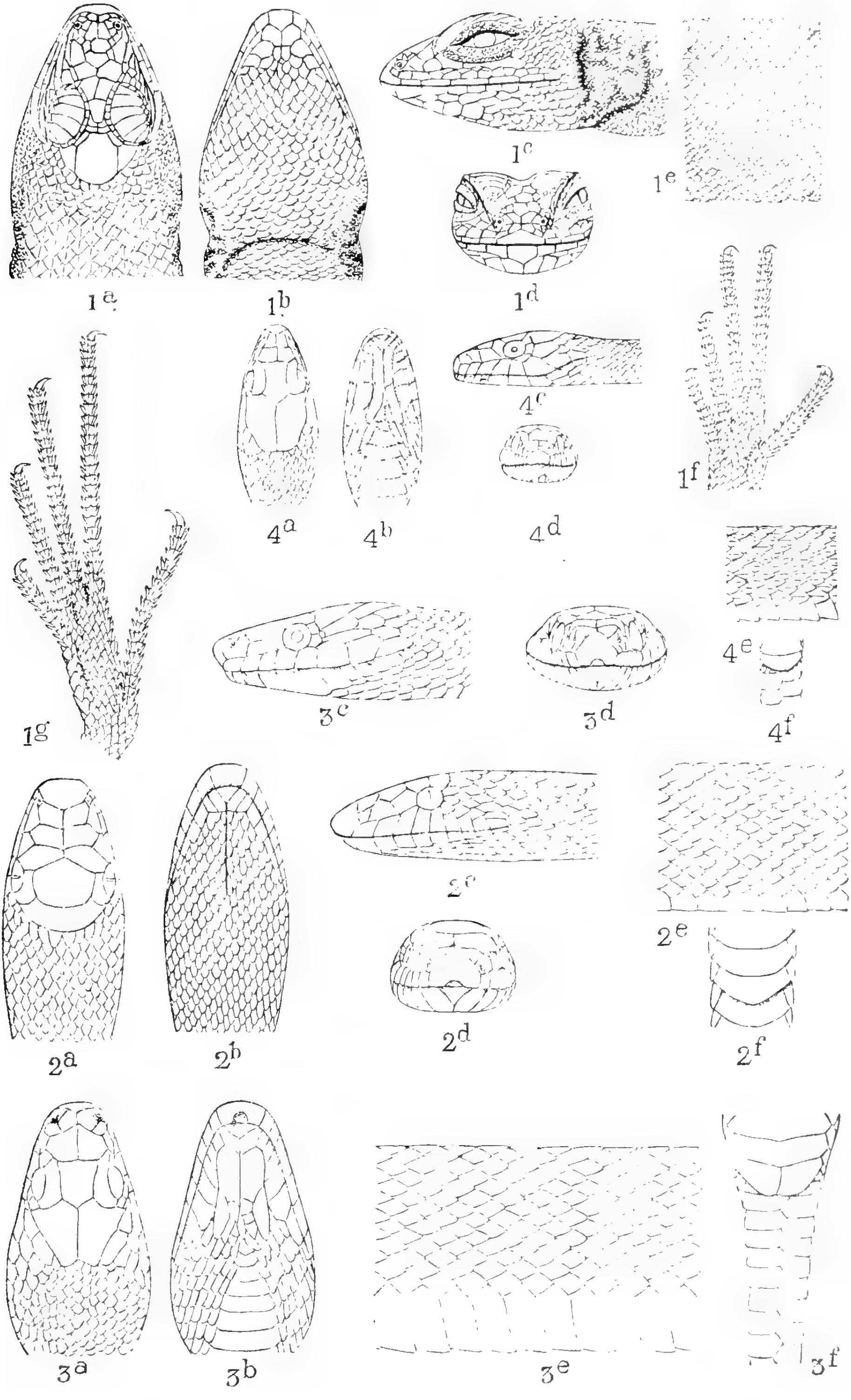


FIG. 1. *Lysoptychus lateralis*, gen. et sp. nov. (Page 397.)
FIG. 2. *Charina brachyops*, sp. nov. (Page 388.)
FIG. 3. *Coluber rosaceus*, sp. nov. (Page 388.)
FIG. 4. *Natrix compressicauda bivittata*, sub sp. nov. (Page 392.)

(Explanation of plate on page 401.)

the frontal and prefrontal plates are more than usually wide, as compared with their length. In one specimen there are eight superior labials on one side, but this is probably an abnormality. Its twenty one rows of scales separate it from the typical *Eutænia radix*, the species to which it has closest affinity, to say nothing of various peculiarities of coloration. It is nearest the subspecies *haydeni* of the *E. radix*, but differs from it in the interrupted lateral ventral black band and the black labial borders. It also approximates the *E. flavilabris*, but differs in a way opposite from the *E. butleri*. The dark colors predominate in the present species, and the lateral stripe of the gastrosteges is also peculiar to it. In the *E. flavilabris* there is also a large postoral yellow black-edged crescent, as in *E. marciana*, of which no trace appears in *E. r. melanotænia*. Two specimens, Nos. 90 and 312.

7. Eutænia saurita L. Two specimens, No. 318.

EXPLANATION OF PLATE XXXVI.

Fig. 1. *Lysoptychus lateralis* Cope, type; from San Diego, Tex., x, 2. Fig. *e*, scutellation from dorsal to ventral regions; Figs. *f* and *g*, anterior and posterior feet, from below. Page 397.

Fig. 2. *Charina braclyops* Cope, type; from Point Reyes, Cal., x, 2. Page 88.

Fig. 3. *Coluber rosaceus*, Cope, type; from Key West, Fla.; $\frac{1}{1}$. Page 388.

Fig. 4. *Natrix compressicauda bivittata* Cope, type; Georgiana, Fla.; $\frac{1}{1}$. Page 392.

July 5, 1889.

THE STONE AGE AT MOUNT VERNON.

BY OTIS T. MASON.

The estate of General George Washington comprised 6,000 acres of land, lying along the Potomac River 14 miles south of Washington, and bounded on the south by Dogue or Ipsawasson Creek and the land of Lord Fairfax.

John Smith, in his exploration of the Potomac River, mentions the Indians living in this neighborhood, and a few of their occupations. Having spent my youth upon this estate I am able to recall the resources of the region as they existed in the seventeenth century.

In the winter the inlets and water courses of Mount Vernon were thronged with wild fowl, white rabbits, squirrels, quails, and deer abounded in the woods. On the approach of spring the numbers of shad and herring that thronged the waters were simply incredible to one who never saw them in the early days. Later on the sturgeon and other fishes took the place of the migratory shoals, while the woods abounded in fruits of all kinds known in this region. Add to all this the fact that these Indians were corn-planters and had some knowledge of rude agriculture, and we are ready to study the stone implements found on the estate.

Those who have examined the region carefully are not wholly agreed about the continuance of man on this area. We have along all the water courses excellent stone implements, with soapstone vessels and fragments of pottery. On the hills back from the waters the pottery disappears and the stone artefacts are decidedly ruder.

On the western side of the Mount Vernon estate, upon a high hill two miles back from the Potomac River, lies the Woodlawn mansion, the home of Nellie Custis, Washington's favorite granddaughter. Here is found what may almost be called the Woodlawn type of ax, so rude is it, a flattish oval pebble, barely chipped at one end for an edge, and having the least possible working at the hafting place. No pottery or arrowheads or other finely flaked implements occur here. All the pieces are coarse and many types are wanting.

The two theories that confront us are these:

First. There were two waves of population that swept over this area, the later being that of the John Smith Indians, the former running back, some say, into paleolithic times.

Second. The shore collections stand for the dwelling places of the Indians, while the pebble-abounding hills farther back were the workshops of the same people where they fabricated their implements and where they abandoned chips, spalls, cores, broken artefacts, and such as could not be satisfactorily finished.

CATALOGUE OF THE MYRIAPODS OF INDIANA.*

BY CHARLES H. BOLLMAN.

The following catalogue of the myriapods of the State of Indiana is based largely upon the material contained in the museum of the Indiana University and my own private collection. I have also included any notes, bearing upon the myriapods of Indiana, that I have found in the papers of other authors. The material in the museum of the Indiana University and my own collection is principally from the following localities:

Boswell, Benton County	D. M. Mottier.
La Fayette, Tippecanoe County	F. B. Webster.
Kokomo, Howard County	A. W. Moon.
Westfield, Hamilton County	F. C. Test.
Indianapolis, Marion County	F. C. Test.
Hagerstown, Wayne County	F. C. Test.
Richmond, Wayne County	F. C. Test.
Dublin, Wayne County	Jerome McNiell.
Greencastle, Putnam County	O. P. Jenkins.
Terre Haute, Vigo County	W. S. Blatchley.
Connersville, Fayette County	Robert Hesler.
Brookville, Franklin County	A. W. Butler.
Bloomington, Monroe County	C. H. Bollman.
Lawrenceburgh, Dearborn County	D. M. Mottier.
Mitchell, Lawrence County	C. H. Bollman.
Salem, Washington County	C. H. Bollman.
New Providence, Clark County	C. H. Bollman.
Wyandotte, Crawford County	C. H. Bollman.
New Harmony, Posey County	R. D. Owen.

I desire to express my thanks to the above-named gentlemen, who have kindly collected specimens for me, thus enabling me to make this catalogue much more complete and satisfactory than would have been possible without their aid. As more species have been found about Bloomington I have given it, when mentioning the localities of the different species, precedence over the other places.

I do not mean to say that this list is complete, for I think the following additional species will some time be found within the limits of the State: *Parajulus canadensis*, *Parajulus diversifrons*, *Polydesmus pinetorum*, *Theatops spinicaudus*, *Henicops fulvicornis*, and *Lithobiusmordax*.

1. Polysonium rosalbum (Cope).

Common: Bloomington; Terre Haute.

---

* This catalogue is prepared partly from material in the U. S. National Museum collection, and the author has deposited types of the species in the Museum.—C. V. RILEY, *Curator of Insects*.

2. Spirobolus americæ-borealis (Beauvois).

Common: Bloomington; Boswell; Kokomo; La Fayette; Terre Haute; Greencastle; Brookville; New Providence; Wyandotte; New Harmony.

3. Parajulus venustus (Wood).

Common: Kokomo; La Fayette; Westfield; Terre Haute; Greencastle; Salem; Brookville; New Harmony.

4. Parajulus impressus (Say).

Rare: Bloomington; Connersville; Brookville.

5. Parajulus rugosus (Bollman).

Rare: Terre Haute.

6. Parajulus pennsylvanicus (Brandt).

Common: Bloomington; Wyandotte; Brookville.

7. Cambala annulata minor, subsp. nov.

Diagnosis: Similar to *C. annulata*, but much smaller and of a yellowish-brown shade.

Habitat: Bloomington, Greencastle, Salem, New Providence, Wyandotte, and New Harmony, Ind.; Little Rock, Ark.

Types: U. S. National Museum.
Nos. 1, 97, 109, collection Indiana University.
Nos. 24, 376, 440, author's collection.

Cambala annulata.

Author's collection.	Habitat.	Collector.	Length.	Width.
			mm.	*mm.*
278	Chapel Hill, N. C	G. F. Atkinson	58	3. 1
225	Mossy Creek, Tennessee	C. B. Branner	45	3.
229	......do	.... do	40	2. 5

Cambala annulata minor.

424	Bloomington, Ind	C. H. Bollman	37	1. 5
424	......do	......do	25. 5	1. 2
376	Wyandotte, Ind	.. do	30	1. 3
440	Little Rock, Ark	W. J. Hutcherson	27. 5	1. 5
440	......do	..... do	25	1. 2

The above figures clearly show the difference in size between the two forms. The color of *C. annulata* is a dark brown, while that of *minor* is usually more yellow.

C. annulata minor is abundant in southern Indiana, and I have over twenty-five specimens from Little Rock.

The specimens Packard has recorded as occurring in Little Wyandotte Cave, Indiana, and Zwingler's & Carter's Caves, Kentucky, are probably examples of this new geographical subspecies, but they may be cave varieties.

8. Julus hortensis (Wood).

Common: Hagerstown; Indianapolis; Connersville; New Harmony.

9. Julus virgatus (Wood).

Common: Bloomington; Westfield; Connersville; Salem.

10. Nemasoma stigmatosum (Brandt).

Rare: Bloomington.

11. Nemasoma minutum (Brandt).

Common: Bloomington; Indianapolis; Salem; New Providence.

A careful examination of the above two species has shown that they should be put in the European genus—*Nemasoma* Koch.

12. Callipus lactarius (Say).

Abundant: Bloomington; La Fayette; Kokomo; Westfield; Terre Haute; Greencastle; Brookville; Salem; New Providence; Wyandotte.

13. Campodes flavicornis Koch.

Very common: Bloomington; La Fayette; Salem.

14. Scotherpes lunatum (Harger).

Common: Bloomington; Salem.

15. Scotherpes wyandotte, sp. nov.

Diagnosis: Related to *Cr. lunatum* (Harger), but the color dark, ocelli arranged in a triangular patch, and the body larger and more robust.

Habitat: Wyandotte, Indiana.

Type: U. S. National Museum.

Description: Body stout, short, scarcely depressed. Dorsal plates reticulated; lateral carinæ as in *lunatum*. Ocelli 16–4, in a triangular patch. Yellowish-brown; legs pale. Length, 10^{mm}; width, 1.5^{mm}.

This new species is described from a female which was found a few miles north of Wyandotte Cave, Crawford County.

16. Scotherpes bollmani (McNeill).

Abundant: Mayfield's, Neeld's, Truett's and Coon's Caves, Bloomington; Phitt's and Donehue's Caves, Bedford, Ind.

17. Pseudotremia cavernarum (Cope).

Wyandotte, Little Wyandotte, Bradford and Marengo Caves, Crawford County, Ind.

18. Pseudotremia carterensis (Packard).

Around the mouth of a well at the foot of the path leading from the hotel, past Little Wyandotte Cave, I obtained five specimens of a *Craspedosoma* that seem to agree with the description of *Pseudotremia cavernarum carterensis* Packard from Bat. X, and Zwingler's Caves, Kentucky.

That this is a distinct species and not merely a variet yof *C. caver-*

narum is distinctly shown by the male copulation foot, the size and color of body, and its *habitat*.

My largest specimen—a male—is 30^{mm} long and 2.2^{mm} wide.

19. Leptodesmus placidus (Wood).

Mr. Mottier has sent me two specimens of this rare species from Boswell, Benton County.

20. Fontaria virginiensis (Drury).

Common: Bloomington; Boswell; Westfield; Terre Haute; Connersville; Brookville. This is the species described from Brookville by Mr. McNeill under the name of *Polydesmus butleri*.*

21. Fontaria coriacea Koch.

Polydesmus corrugatus Wood, Proceed. Acad. Nat. Sci. Phila., 6, 1864 (*Michigan, New York*).

Common: Bloomington; Boswell; Kokomo; Wyandotte.

A comparison of specimens of *corrugata* Wood with Koch's figures and descriptions of *coriacea* shows that they are the same. Koch's figures show a broad yellow band along the posterior margin of each segment. This is a character common to the eastern specimens, but rare in the western forms.

22. Fontaria indianæ, sp. nov.

Diagnosis: Related to *Fontaria coriacea* Koch, but the copulation foot expanded near the middle, end angularly bent inwards, basal spine *bifid;* lateral carinæ more rounded; legs of male stouter; segments always margined posteriorly with yellow.

Habitat: Hagerstown and Brookville.

Types: U. S. National Museum (Brookville and Hagerstown). No. 37, Museum Indiana University (Brookville). No. 519, author's collection (Brookville). No. 253, author's collection (Hagerstown).

Measurements of Fontaria indianæ.

	Habitat.	Collector.	Length.	Width.	Height.	Sex.
			mm.	*mm.*	*mm.*	
No. 37, Museum Indiana University	Brookville	A. W. Butler.	34	9	5 5	♂
No. —, U. S. National Museum	do	do	38	8.5	6.5	♀
No. 519, author's collection	do	do	39	9	6	♀
No. —, U. S. National Museum	do	do	31	7.5	4.5	♂
No. 253, author's collection	Hagerstown	F. C. Test	38	8	6	♀

This species is described from ten specimens, four females and three males from Brookville, Franklin County, and three females from Hagerstown, Wayne County. It agrees with the eastern specimens of *coriacea* in having a broad yellow band along the posterior margin of each segment, but the shape of the male copulation foot, especially the *bifid* character of the basal spine, will serve to distinguish it from *coriacea*.

* *Polydesmus butleri* McNeill, Bull. Brook. Soc. Nat. Hist., No. 3, 6, 1888 (*Brookville, Ind*).

23. Fontaria butleriana, sp. nov.

Diagnosis: Related to *Fontaria coriacea* Koch, but the segments strongly attenuated posteriorly; size larger and width less in proportion to the length; dark greenish-black, with a narrow yellow line along the posterior border of each segment.

Habitat: La Fayette and Brookville.

Type: U. S. National Museum; No. 520, author's collection.

Measurements of Fontaria butleriana.

	Habitat.	Collector.	Length.	Width.
			mm	*mm*
No. —, U. S. National Museum	La Fayette, Ind.	F. B. Webster	44	11
No. 520, author's collection	Brookville, Ind.	A. W. Butler	41	10

The above measurements, when compared with those of *Fontaria coriacea* clearly show the difference in size.

This species is described from two females—one from each locality.

It approaches very closely to Koch's figures of *F. virginiensis*, and it is probable that he has described this species as *virginiensis*.

24. Euryurus erythropygus (Brandt).

Abundant: Bloomington; Boswell; La Fayette; Kokomo; Westfield; Terre Haute; Greencastle; Mitchell; Salem; New Providence; Brookville; Wyandotte.

25. Scytonotus granulatus (Say).

Abundant: Bloomington; La Fayette; Westfield; Greencastle; Salem; New Providence.

26. Scytonotus cavernarum Bollman.

Bloomington; Mayfield's Cave; only the original type known.

27. Chætaspis albus Bollman.

Not common: Bloomington; Salem; New Providence.

28. Polydesmus testi Bollman.

Rare: Indianapolis.

29. Polydesmus minor Bollman.

Boswell. One specimen.

30. Polydesmus serratus Say.

Abundant throughout the State.

31. Eurypauropus spinosus Ryder.

Abundant: Bloomington.

32. **Pauropus lubbocki** Packard.

Rare: Bloomington.

33. **Linotænia chionophila** (Wood).

Common: Bloomington; La Fayette.

34. **Linotænia fulva** (Saeger).

Common: Bloomington; Brookville; Salem.

35. **Linotænia ruber** Bollman.

Common: Bloomington; Boswell; LaFayette; Westfield; Greencastle; Salem; Brookville; New Providence; Wyandotte.

36. **Geophilus brunneus** McNeill.

Common: Bloomington.

37. **Geophilus salemensis** Bollman.

Common: Salem; Wyandotte.

38. **Geophilus varians** McNeill.

Very common: Bloomington; Salem; New Providence.

39. **Geophilus umbraticus** (McNeill).

Common: Bloomington; Boswell; Salem.

40. **Geophilus indianæ** McNeill.

Rare: La Fayette (*McNeill*).

41. **Geophilus rubens** Say.

Common: Bloomington.

42. **Geophilus oweni** Bollman.

New Harmony. Two type specimens.

43. **Geophilis smithi** Bollman.

Bloomington. One specimen; length 36^{mm}.

44. **Geophilus setiger** Bollman.

Rare: Salem.

45. **Geophilus strigosus** (McNeill).

Rare: Bloomington; Salem.

46. **Geophilus foreatus** (McNeill).

Not common: Bloomington; Salem; Lawrenceburgh.

47. **Geophilis attenuatus** Say.

Common: Boswell; La Fayette; Kokomo; Westfield; Terre Haute; Brookville; Wyandotte.

48. **Scolopocryptops sexspinosus** (Say).

Very common throughout the State.

49. Scolopocryptops nigridius McNeill.

Common: Bloomington; Greencastle; Brookville; Salem.

50. Cryptops hyalinus Say.

Common: Bloomington; Salem; New Providence; Wyandotte.

51. Theatops posticus (Say).

Common: Bloomington; New Providence; Wyandotte.

52. Scolopendra woodi Meinert.

Bloomington. Two specimens.

53. Lithobius protidens Bollman.

Common: Bloomington; La Fayette; Richmond; Brookville; Salem; New Providence; Wyandotte.

54. Lithobius jowensis Meinert.

Very common: Bloomington; La Fayette; Richmond; Greencastle; Salem; New Providence; Wyandotte.

All the specimens I have examined differ from *jowensis* by having the first pair of legs armed with 2, 3, 2 or 2, 3, 1 spines, instead of 2, 1, 1, as Meinert states; also, by having the inner spine of ♀ genitalia much shorter than the outer. These specimens may represent a geographical variety of *jowensis*, but until the *habitat* of *jowensis* and more specimens can be obtained it is not safe to describe them as such.

55. Lithobius bilabiatus Wood.

Lithobius tuber Bollman. Proceed. U. S. Nat. Mus., 256, 1887.

Rare: Bloomington.

56. Lithobius trilobus Bollman.

Not common: Bloomington; Salem.

57. Lithobius pullus Bollman.

Rare: Bloomington.

58. Lithobius cardinalis Bollman.

Common: Bloomington; Westfield; Salem; New Providence.

59. Lithobius howei Bollman.

Common: Bloomington; Kokomo; Dublin.

60. Lithobius forficatus (Linnæus).

Common in northern part of State, but rare in the southern parts. Bloomington; Westfield; Connersville; Greencastle; Lawrenceburgh.

61. Lithobius tyrannus Bollman.

Common: Bloomington; Lafayette; Greencastle; Salem; New Providence.

62. Lithobius juventus Bollman.

Rare: Bloomington. Four specimens.

63. **Lithobius multidentatus** Newport.

Abundant throughout the State.

64. **Scutigera forceps** (Rafinesque).

Bloomington; New Harmony; Evansville.

INDIANA UNIVERSITY,
Bloomington, December 25, 1888.

LIST OF FISHES NOW IN THE U. S. NATIONAL MUSEUM, COLLECTED IN NICARAGUA BY DR. LOUIS F. H. BIRT.

BY DAVID STARR JORDAN.

A small collection of fishes has been made in Nicaragua by Dr. Louis F. H. Birt. These were sent to the U. S. National Museum, where they were received December 14, 1888. Of these specimens those numbered from 39907 to 39912 are said to be from (Lake ?) Nicaragua; the others (39913 to 39920) from a point 40 miles above the mouth of the Rio San Juan, which is the outlet of Lake Nicaragua. This would be about half-way between the lake and Greytown, at the mouth of the river.

39907, 39908. Ailurichthys filamentosus (Swainson). (*Felichthys filamentosus* Swainson; *Galeichthys blochi* Cuv. & Val.)

This species greatly resembles *Ailurichthys marinus*, with which it has hitherto been usually confounded. It is probable that the latter is chiefly or wholly confined to the coast of the United States, and the tropical representatives of the species belong to the present type, for which *filamentosus* is the oldest specific name.

The chief difference is in the much greater development of the occipital process or buckler in *A. filamentosus* as compared with *A. marinus*. The anal rays in our specimens of *A. marinus* are 23; in *A. filamentosus*, 26; shield on top of head much more extensively rough than in *A. marinus*, the granulations extending on each side of the fontanelle to before it; granulated area before occipital process broader than long, its width more than half head; occipital process triangular, emarginate behind, its width at base about $1\frac{1}{6}$ in its length and highly granular; basal bone of dorsal spine short, but extending down for a considerable distance saddlewise, its prolongations visible through the skin. (In *A. marinus* the occipital process is small and oblong, of nearly the same width behind as before.) Dorsal spine a little shorter than head, little longer than pectoral spine; dorsal filament reaching to or beyond adipose fin; pectoral filament to just beyond front of anal; maxillary barbels to end of pectoral spine; color of *A. marinus*.

39909. Chalcinopsis dentex Günther.

A large specimen.

39910, 39911. Rhamdia guatemalensis (Günther).

These specimens agree fairly well with Günther's account, except that the tip of the anal does not reach nearly to the end of the adipose fin, when laid backward. One has 12 anal rays, the other 13.

39912. Heros motaguensis Günther.

Two specimens; no distinct dark spot on subopercle; otherwise agreeing fairly with descriptions.

39913. **Eulamia nicaraguensis** Gill.

A good specimen of this interesting fresh-water shark, agreeing well with Gill's description; both dorsals and caudal edged with black.

39914. **Philypnus dormitor** (Lacépède). (*Eleotris longiceps* Günther.)

39915. **Heros dovii** Günther.

39916. **Heros basilaris** Gill and Bransford.

Four specimens.

41001. **Heros aureus** Günther.

Small specimens, numbered as young of the preceding.

39917. **Heros nigrofasciatus** Günther.

Two specimens.

39918. **Tetragonopterus fasciatus** (Cuvier).

39919. **Heros nicaraguensis** Günther.

Head less elevated above than in Günther's figure; lateral spot very distinct; other bands very obscure.

39920. **Heros friedrichsthali** Heckel.

No distinct dark cross bands.

39958. **Anacyrtus guatemalensis** Günther.

This specimen was with the others, but it is not included with the memoranda of Dr. Birt's collection.

Of the fourteen species here enumerated none are new. The following do not seem to have been previously recorded from the basin of Lake Nicaragua:

Ailurichthys filamentosus.
Rhamdia guatemalensis.
Tetragonopterus fasciatus.
Chalcinopsis dentex.
Heros aureus.
Heros nigrofasciatus.
Heros motaguensis.
Heros friedrichsthali.

INDIANA UNIVERSITY, *March* 14, 1889.

NOTES ON SOME ALBINO BIRDS PRESENTED TO THE U. S. NATIONAL MUSEUM, WITH SOME REMARKS ON ALBINISM.

BY LIEUT. WIRT ROBINSON, FOURTH ARTILLERY, U. S. ARMY.

The following notes refer chiefly to specimens obtained by the writer in Virginia, and presented to the National Museum in February, 1889:

Sora (*Porzana carolina*).

(*a*) Killed September 20, 1870, in Curl's Neck Marsh, James River, Virginia. Nearly perfect albino. Feet and bill pale yellow; irides pink (glass eyes wrong color); a few brownish and buff-colored feathers on flanks, around neck and eyes; sex not determined.

(*b*) Killed October 2, 1880, in Curl's Neck Marsh, James River, Virginia. All features normal except patch of white feathers covering occiput; sex, male.

(*c, d*) September 23, 1882, bought two skins from a wagon in Richmond, Va., containing between 900 and 1,000 *dozen* sora, nearly all "paddled" in Curl's Neck Marsh, on James River. The remarks about the meadow-lark below are applicable to these. A good idea of their coloration would be obtained by supposing that an accurate water-color drawing of a sora were washed out until the darkest colors were somewhere about a buffy, a yellow ocher, and a pale fawn color; bill and feet pale yellow; color of irides and sex not determined.

Among the thousands of sora exposed for sale in the streets and markets of Richmond every fall this phase of albinism is by no means rare. A number of specimens could be obtained each season.

Meadow-lark (*Sturnella magna*).

Killed December 19, 1875, in Buckingham County, Va. An approach to albinism, all the markings and mottlings present, but colors have a washed-out appearance, and are of about one half the intensity of those of the normally colored individual. The irides were normal (?) and bill and feet slightly paler. Was with a large scattering flock. Sex not determined.

Red-winged Blackbird (*Agelaius phœniceus*).

Killed September 18, 1872, in Curl's Neck Marsh, James River, Virginia. A poor skin, because of decomposition setting in before it was possible to remove it. Perfect albino; feet and bill pale yellow; irides pink; tail feathers badly worn and apparently lifeless, resembling those of the emu wren as given in the wood-cuts of that bird; faint tinge of yellowish pink on shoulders; sex, male.

Cow Blackbird (*Molothrus ater*).

November 5, 1881, I saw in Henrico County, Va., in the midst of a large flock, a white cow blackbird, but could not get a shot at it.

Slate-colored Junco or Snow Bird (*Junco hyemalis*).

Killed February 24, 1879, in Henrico County, Va. Bill, feet, and irides normal. Isolated white feathers scattered throughout rest of plumage, but these not noticed until after the bird was shot. Sex not determined.

Field Sparrow (*Spizella pusilla*).

(*a*) Killed February 14, 1880, in Chesterfield County, Va. Tail mainly white; white feathers in each wing, rest of plumage normal; sex not determined.

(*b*) Killed December 3, 1881, at Currituck, N. C., on the beach. Nearly perfect albino; plumage white with a faint buffy tinge on upper parts; bill and feet light yellow; irides pink; sex not determined.

(*c*) Killed in Chesterfield County, Va., but did not skin, a field sparrow with numerous white feathers scattered throughout plumage.

House Sparrow (*Passer domesticus*).

June 12, 1882, saw in the streets of Richmond, Va., an English sparrow with both wings nearly white.

Cedar Bird (*Ampelis cedrorum*).

Killed September 29, 1873, on an island in James River, opposite Richmond, Va. Was feeding with a large flock upon sugar berries. An interesting specimen; almost perfect albino; feet and bill pale yellow; irides pink; a few dark feathers in the wings, rest of plumage pure white, except that the yellow tips of the tail feathers and the yellow of the belly and the scarlet wax-drops of the wings remained unchanged; sex not determined.

Robin (*Merula migratoria*).

(*a*) Killed February 26, 1880, in Chesterfield County, Va.; normal feathers profusely intermixed with white ones; all feathers of tail but one white; primaries and secondaries largely white; very noticeable during life, the bird appearing as if sprinkled with snow. Impossible to save skin, except that of neck and head. Irides normal; bill and feet slightly paler; sex, male.

(*b*) Killed March 17, 1880, in same locality as above; most perfect albino among the lot; plumage entirely white, though badly soiled; bill and feet very pale yellow; irides pink; sex, not determined.

Bob-White (*Colinus virginianus*).

November 29, 1881, was shown the white wings of a "partridge," killed in Albemarle County, Va., the rest of whose plumage was said to have been normal.

Crow (*Corvus americanus*).

May 26, 1879, saw at a distance, in Henrico County, Va., a crow with a large white spot in each wing; was unable to get a shot at it.

Turkey Buzzard (*Cathartes aura*).

March 11, 1882, in Henrico County, Va., saw a turkey buzzard with several white primaries in each wing.

The subject of albinism among birds has always been a matter of interest to me, and I have carefully read whatever I have had access to upon this subject, as well as articles upon the coloration of the feathers and changes of coloration, and albinism in general; but I must confess that such information as I could obtain has been meager and unsatisfactory in the extreme, most authors merely referring to albinism as a fact, and giving no further explanation than that they were ignorant of its causes. Darwin refers to it several times, but discusses it more as a matter of heredity. It is easy to see the difficulty of studying this phenomenon among birds, for, first, its instances are rare; second, when they are met with the bird is immediately destroyed, if possible, and its skin secured; third, the absence of means for ascertaining the changes (if any) that the bird has gone through from the moment it was hatched until it was secured; and fourth, it is hardly probable that a private collector, even during a life-time, should meet with a sufficient number of examples to enable him to draw up with any confidence generalizations from his observations which would include all cases.

We are therefore driven to consider the cases of albinism that we can observe during their existence, and then by analogy apply our deduction to birds. This is unsatisfactory and uncertain.

There is the human albino, too well known to need description; then, among other mammals, instances of hereditary albinism; as, for example, English rabbits, white rats and mice, etc. Among domesticated birds it is rarer; a white plumage made hereditary by interbreeding, as (to take the more recent instances) in white turkeys, guinea hens, etc., not constituting a perfect albinism as we understand it. Considering these cases, we find that for the mammals:

(1) Albinism exists as a freak—has its inception in embryo, exists from the moment of birth, affects, *as a rule*, the entire body and lasts through life.

(2) The negative statement of the above: It is not the result of disease; the whitening of the skin and hair produced by leprosy and kindred diseases not constituting true albinism.

(3) It arises, in the human being, "from the absence of the minute particles of coloring matter which occur in the lowest and last deposited layer of the epidermis."

Now, if we endeavor to apply these conclusions to birds, we immediately meet with difficulties; for instance:

(1) "Albinism exists as a freak, has its inception in embryo, exists from the moment of birth." (Since the receipt of your favor of the 12th ultimo,* stating that there are in the National Museum several specimens showing that some albinos are hatched pure white, we must without hesitation admit that much; but does it follow that all albinos are

* Reference is here made to a letter from the Curator of the Department of Birds.

so from the moment they are hatched? Are we to consider that the pied and spotted specimens among those which I have collected were always in that condition?* Can we not suppose with equal confidence that they were originally normally colored, and that as their feathers were lost by molting, they were replaced by white ones, and that finally by this process of substitution albinism was produced? This does not seem stranger to me than the provision of nature by which the feathers of the ptarmigan, at one season mottled, are, at the next, replaced by white ones, the latter growing from the same papules, supplied by the same blood vessels, etc. And this theory would seem to be further confirmed by the fact that sometimes in albinos, perfect in every other respect, there are found one or two feathers normally colored, and the remainder of the plumage of snowy whiteness, as if in molting. These one or two feathers had, so to speak, stuck and remained over another season. How else can we account for their color, when all the contiguous feathers, which we have every reason to suppose are in the same physical condition, are white?) "It affects, *as a rule*, the entire body." This must be cautiously received when referring to birds. How can we account for the spotted and pied specimens?

(2) "It is not the result of disease." I do not know enough about this matter to enter into any discussion upon it, still, in the case of the meadow-lark and two pale-colored sora, it almost seems as if the coloring matter was being gradually withdrawn or re-absorbed from the feathers, causing them to fade.

In the cases of albinism which I have observed yellow seems to be the color least affected.

By a study of an extensive series of albinos, such as I have not had access to, a great many interesting facts would be developed in regard to the coloring of feathers. Thus, it is stated that certain blues, violets, and greens are not due to the pigment (which is gray), but to surface structure of the feather. Therefore, the feather of an albino of a species of parrot having such colors, when dipped into a grayish tincture, should reproduce those blues, violets, and greens, if the first statement be correct. If I recollect, it was Dr. Wollaston who discovered that the brilliant colors of the "speculum" of such ducks as the common mallard were produced in the same way that the spectra are produced in optics, by light reflected from the surface of a highly polished piece of speculum metal, which has been ruled with microscopically fine parallel lines. For this reason, I have always looked out for an albino of such a duck, but have never yet had the good fortune to meet with one. It would be highly interesting to test this matter by staining the feather of such an albino a light gray.

---

* There can be no question that some albinos, or partial albinos, were at a previous stage of their existence normally colored. I have had personal knowledge of such cases, and have even seen a melanistic robin (*Merula migratoria*), entirely black in its first plumage, assume numerous perfectly white feathers after a molt, and believe that the bird *might* have eventually become an albino, though its premature death prevented further observation.—R. RIDGWAY.

DESCRIPTION OF A NEW SPECIES OF DEER, CARIACUS CLAVATUS, FROM CENTRAL AMERICA.

BY FREDERICK W. TRUE.

In Messrs. Salvin and Godman's *Biologia Centrali-Americana*, Alston enumerates four species of deer as inhabitants of the region between Texas and the Isthmus of Panama. These are *Cariacus macrotis* (Say), *Cariacus virginianus* (Boddaert), *Cariacus toltecus* (Saussure), *Cariacus rufinus* (Bourcier et Pucheran). Of these, the first three belong to the subgenus *Cariacus*, as defined by Sir Victor Brooke, and the fourth to the subgenus *Coassus*.

It is now my intention to add to the list of Central American deer a fifth species, which, as I shall presently show, presents a superficial resemblance to the species of the subgenus *Coassus*, but belongs in reality to the subgenus *Cariacus*.

The description is based upon a good series of specimens in the National Museum, including young and adult individuals of both sexes. The species never acquires branched antlers, and I have therefore chosen for it the name of *Cariacus clavatus*.

DESCRIPTION OF CARIACUS CLAVATUS.

Stature medium; antlers simple spikes, directed backwards nearly in the line of the face. In general appearance and color like *C. virginianus*. A small metatarsal gland present. Hoofs yellowish at the extremity.

Male, young, summer pelage.—General color bright chestnut. Head grayer than the back. A white spot on each side of the rhinarium, succeeded by an oblique dusky-brown band, which reaches from the nostril to the margin of the upper lip, and is continued by a spot on the margin of the lower lip. Behind the dusky band is one of whitish gray, which is merged into dark gray posteriorly. The latter color is strongly tinged with chestnut on the cheeks, temples, and forehead. The median line of the face is occupied by a dusky-brown band, which extends backwards nearly to the line of the eyes. The forehead is occupied by a broad crest of long reflexed hairs, which in the mass are darker than those of the face. The individual hairs are brownish-gray at the base, darker near the tip, where this color is succeeded by a ring of light yellow, more or less reddish; the tips of the hairs are dusky brown. There is a whitish-gray ring around the eye, conspicuously lighter than the gray of the face.

The outer surface of the ear is for the most part gray, but there is a rather large area of nearly pure white at the base of the posterior free margin, and another smaller area at the base of the anterior margin.

July 5, 1889.

The latter is continued inside the ear by a fringe of long white hairs, which grow shorter upwards and are replaced about the tip of the ear by short hairs, closely set. The posterior inner margin of the ear is clothed with short hairs which are more or less tawny at the base of the ear, but white at its tip. These characters are much less clearly observable in the summer coat than in the winter coat. In the former, the hair of the back of the ear is often entirely rubbed off, and the inner side is only scantily clothed.

The back is of a nearly uniform light chestnut or tawny color. The hairs are gray at the base and grow darker above. The tips are black, while between this color and the gray is a chestnut or tawny ring. On the flanks the basal half of the hairs is whitish and the distal half pale chestnut, without a black tip. The hair on the buttocks is the same, but is fully $2\frac{1}{2}$ inches long.

The color of the tail above is tawny, like the back, but the hairs are dark brown in the basal half. The hair of the under side of the tail, the perinæum, the scrotum, the inside of the thighs, and the abdomen nearly to the navel, is long and pure white.

The tawny color of the flanks extends without interruption over the chest. The median line of the breast is dusky brown. The neck is pale grayish chestnut, the gray color being due to the fact that the gray of the lower part of the hairs is mingled with the color of the upper parts of the same.

The jaw and throat are white, except that there are, as already stated, two dusky brown spots on the margin of the lower lip.

The color of the upper surfaces of the body is continued on the legs. The proximal half of the inside of the fore legs is pure white; but distally there is little difference in the color of the inner and outer surfaces. The same is true as regards the distal half of the hind legs; the inside of the upper hind leg, however, is paler than the outside, but is not pure white.

The hairs of the tarsal gland are pure white; of the very small metatarsal gland, scarcely lighter than that of the surrounding tawny-gray area, so that this gland is only with much difficulty to be found.

Male, winter coat.—As in other species of *Cariacus*, the winter coat is gray instead of tawny, the general color being that commonly known as "pepper-and-salt." Behind the navel, as far as the penis, the color is tawny rather than pure white. The tarsal gland is surrounded by blackish hairs, but outside of these, anteriorly, there are some white hairs. The surrounding area is tawny-gray. On the upper side of the tail the hairs are all dusky brown at the base and tawny at the tip. Legs gray.

COMPARISON OF THE SKULL OF C. CLAVATUS WITH THAT OF C. VIRGINIANUS.

Compared with *C. virginianus*, the forehead of *C. clavatus* is flatter. The level is maintained as far as the proximal end of nasals, beyond

which it dips down, so that the nasal bones are more curved than those of *C. virginianus*. The skull is much deeper in front of the eyes in *C. clavatus* than in *C. virginianus*; the eyes are larger, the lachrymal bone also larger and its free margin more convex, while the lachrymal pit is shallower. The orbital processes of the frontal and malar, forming the back of the orbital ring, are much the broadest in *C. virginianus*, and are more transverse.

The pedicels of the antlers are directed upwards much more in *C. clavatus* than in *C. virginianus*. The tube of the exterior auditory meatus is much larger in the former than in the latter, and extends beyond the superlying ridge of the squamosal so that it is plainly seen upon looking down upon the skull from above. The tube of the internal meatus is also prolonged in *C. clavatus* and ends in a sharp point.

ANTLERS.

The antlers of young males of *C. clavatus* are simple, slightly curved spikes. The burr is small and moderately rugose. In a young individual from Tehuantepec, no. 9442, and in no. 14212 the antlers are more or less triangular in section. In the adult males, like no. 13038 from Costa Rica, the antlers are slightly lyrate, considerably compressed laterally, and sharply pointed. The burr, though broad, is in some cases not distinctly marked off from the beam, and the rugosities extend up the anterior surface of the latter along the basal two-thirds in antlers which are little worn. The right antler of no. 13038 is deformed, the beam being bent over backwards and downwards, so that the tip is on a line with the burr.

In no. 13040 the antlers are abnormal; the beams are straight, slender, and smooth, and are distinctly marked off from the burr, somewhat as in the Roebuck (*Capreolus*). In no. 14212 the antlers are of typical form, but the upper half has been worn perfectly smooth by rubbing.

DISCUSSION OF THE AFFINITIES OF C. CLAVATUS.

Were it not for the difference in age among the specimens now before me, it might be thought that they were merely the young of some known species with branched antlers. That such is not the case becomes evident upon examination of the skulls. In the largest male skulls the teeth are those of the second or permanent set, and the crowns of the same are well worn. Furthermore, the sutures of the base of the skull are obliterated by anchylosis and the pedicels of the antlers are much enlarged. There can be no doubt that this is the skull of an adult individual.

The condition of the teeth and of the sutures at the base of the skull is shown in the following table:

Catalogue number.	Sex.	Dentition.	Last tooth in position.	Condition of teeth.	Suture between basi-occipital and basi-sphenoid.	Suture between basi-sphenoid and pre-sphenoid.	Basi-cranial length.	Length of antler.
							mm.	*mm.*
13043/11384	♂	Milk	m^{1*} / m^{1}		Open	Open	166	None.
8133/7030	♂	...do	$m^{2\dagger}$ / $m^{2\dagger}$		... do	... do	166	None.
22828	♂	...do	$m^{3\ddagger}$ / $m^{3\ddagger}$		....do	....do	195	51
13039/11385	♂	Permanent	All	Unworn	Closed	....do	223	96
13040	♂	....do	All	Slightly worn	....do	....do	224	§63
14212	♂	....do	All	Moderately worn	....do	do	225	100
13038	♂	....do	All	Well worn	... do	Closed	234	104
13042/11386	♀	Milk	$m^{3\ddagger}$ / $m^{3\ddagger}$		Open	Open	193	None.
22829	♀	...do	$m^{3\ddagger}$ / $m^{3\ddagger}$		....do	....do	194	None.
13485	♀	Permanent	All	Slightly worn	Closed	Open	202	None.

* Nearly cut. † Half cut. ‡ Almost in position. § Antlers diseased.

The question of whether *C. clavatus* may not be identical with some previously-described species having simple antlers merits more serious attention.

It must be taken into consideration at the outset that in dealing with species having simple horns we are debarred from employing one series of characters which are universally used in distinguishing between the different groups of deer with branched antlers, namely, those drawn from the form of the antlers themselves. While it is fitting, for example, that the species of *Dama* should be separated from the *Cervus* group, on account of the difference in the form of the antlers, if for no other reason, it will not, on the other hand, be logical to bring together into one group all species possessing simple antlers; for, on account of their very simplicity, these antlers lack tangible characters. We are forced, therefore, to turn to other parts to find the means of discrimination.

It is unquestionable, I believe, that our new deer belongs to the genus *Cariacus*, but the question as to which subgenus of the group it falls in remains to be answered. Our first inclination would be to place it in *Coassus*, on account of its lacking branched antlers, but, as we have just pointed out, it is unsafe to trust to this negative character. In fact, on account of other characters which we will now consider, *C. clavatus* can not be placed in that subgenus.

In Sir Victor Brooke's Revision of the Cervidæ,* four subgenera of Cariacus are recognized. These are, *Furcifer*, *Blastoceros*, *Cariacus*, and *Coassus*. The first two of these groups I shall be obliged in the present connection to regard as sections of the subgenus *Cariacus*, for, aside from the form of the antlers, I find no tangible characters in

* Proceed. Zool. Soc., London, 1878, pp. 883–928.

Brooke's diagnoses by which the species may be distinguished from those of *Cariacus.* The small amount of material which I have been able to examine seems to warrant such a disposition of them. *Coassus*, on the other hand, presents many characters which distinguish it from *Cariacus.* In Brooke's valuable diagnoses four differential characters may be found. These are as follows: In *Coassus* (*a*) the auditory bullæ are less inflated than in *Cariacus;* (*b*) the rhinarium is ample, as in *Crevulus;* (*c*) the facial profile is more arched than in *Cariacus;* and (*d*) the stature is small. In the first three of these characters our new species agrees with *Cariacus* rather than with *Coassus.* The fourth character, relating to stature, is perhaps scarcely worthy of consideration as a subgeneric distinction; it is a matter apparently correlated with the small size of the antlers. To bring together our new deer and the various species of *Coassus*, on account of their small size, would not be more logical than to approximate two large species merely on the score of their common magnitude.

Leaving size out of consideration, therefore, *C. clavatus*, judged by the diagnoses of Sir Victor Brooke, belongs in the subgenus *Cariacus.* I now desire to bring forward three additional characters which our new deer possesses in common with the known species of the subgenus *Cariacus* and which separate it from *Coassus.*

It is pointed out by Brooke that in the deer of the New World the vomer extends backward in the nasal cavity, dividing it into two completely separated compartments. Upon examining the vomer in the different species of the subgenus *Cariacus*, *C. virginianus*, *macrotis*, etc., I find that the posterior end of the superior *horizontal* plate, while it covers the presphenoid, does not extend over the suture between the presphenoid and the basisphenoid. The free posterior margin of *vertical* plate is falcate, and in old individuals the attenuated extremity of the same curves backward and touches, or actually grows into, the surface of the basisphenoid. In *Coassus*, on the contrary, the horizontal plate of the vomer extends back far enough to cover the suture between the presphenoid and basisphenoid, and the free posterior margin of the vertical plate is straight or only moderately emarginate. In *C. clavatus* the form of the vomer is that of *Cariacus*, and not of *Coassus.*

As a second distinguishing character, I find that in all the species of the subgenus *Cariacus* the osseous walls of the external auditory meatus are incomplete in the center behind, thus , while in *Coassus* the vacuity occurs much higher up, thus . In this, as in the last character, *C. clavatus* shows a relationship to species of the subgenus *Cariacus.*

The third character to which I shall call attention relates to the arrangement of the hair on the face. The matter of the arrangement of the hair, as Sir Richard Owen has somewhere stated, deserves more attention than it has thus far received. So far as my observations go, the style of arrangement is very constant in individuals of the same species, or in the species of a group. In all the Cats, for example, the hair on

the nose, in advance of the eyes, has the tips directed forwards. In all species of *Bovinæ* which I have examined the hair immediately bordering the muffle or rhinarium is reflexed, but that immediately behind has the tips directed forwards. In the horse, as is well known, there is invariably a long and very definitely marked "part" in the hair on the flanks, immediately in front of the hind leg. Examples of this kind might be greatly multiplied, but it may suffice in this place to say that, considering the constancy in the position and form of these "parts" and divisions of the hair, there is, I believe, no reason why they may not be trusted as indications of relationships.

In all the species of the subgenus *Cariacus* I find that the hair on the median line of the head is directed backward without interruption. In *Coassus*, on the contrary, there are in the median line two "poles," or points from which the hair radiates in every direction. One "pole" is on the crown, and the second about midway between the eyes and the rhinarium. In front of the second pole the tips of the hair are directed forwards to the nostrils. In *C. clavatus* the arrangement is that of the subgenus *Cariacus*, the tips of all the hairs in the median line of the face being directed backwards without interruption.

From the facts adduced it is, I think, proven that our new deer must be regarded as a species of the subgenus *Cariacus*, with simple horns. We may, therefore, consistently omit all further comparisons with the various species of *Coassus*. There is, however, one species with which our new deer might be thought to have close relationship, or to be identical. This is the *Cervus capricornis* of M. de Saussure, described in the *Revue et Magasin de Zoologie*.*

The substance of M. de Saussure's account of this Mexican deer is briefly as follows: While hunting he saw, but did not obtain, a deer of about the size of *C. mexicanus*, armed with large, curved spikes. He at first considered this to be a young Mexican deer, but was afterwards informed by the native hunters that it was well known to them under the name of *Venado cuernicabra*. They also stated that it was rare, and that it never had branched antlers. Before leaving the country he obtained a single right antler, with a portion of the skull attached, which he believed to belong to this species.

His description of this antler is as follows: "Il mesure 0^{m},200, selon la corde de sa courbure; il est très divergent, très-arqué, et n'a qu'une seule courbure qui regarde en haut et en dedans; sa base est très-noueuse, sa couronne médiocre, et la seconde moitié de la corne est comprimée, assez épaisse. De plus, ce bois n'est pas grêle, comme les dagues des jeunes; il a plutôt le caractère de la vieillesse."

That this antler did not belong to an individual of our *C. clavatus* is, I believe, quite certain. The terms "très-divergent" and "très arqué" do not apply to the antlers of our species, but to the dag-antlers of *C. virginianus* and other species of *Cariacus* with branched horns. Further-

* 2nd ser., XII, 1-60, p. 252.

more, the length of the antler in a straight line is greater than that of the antlers of our oldest *C. clavatus.* It is a matter of interest in this connection, that among the antlers in the collection of the National Museum is one from Orizova, which corresponds almost exactly to M. de Saussure's description, and furthermore has upon it the original label of the collector, bearing the words "*Venado cuernicabra.*" This antler certainly does not belong to our *C. clavatus*, but appears to be a dag-antler of the Virginia deer, of which we have many in the collection.

Our species differ from *Cariacus yucatanensis* (Hays) (=*C. acapulcensis* Caton), in the presence of a metatarsal gland, and in the size and form of its antlers. The latter species, according to Mr. Hays, does not change its color, which is not true of *C. clavatus.* There is in the collection of the National Museum a male deer labeled *C. gymnotus*, which was presented by the Zoological Society of Philadelphia, and was supposed to have been derived from South America. It is not clearly distinguishable from *C. yucatanensis*, and also agrees in color with the gray form of our *C. clavatus.* From the latter, however, it is distinguished by the absence of a metatarsal gland and by its forked antlers. It is also much darker on the face and back, while the insides of the legs are whiter. The hairs surrounding the tarsal gland are white, and the hair posterior to the navel has the points directed backwards, while in *C. clavatus* they are directed forwards. The hoofs are black throughout in this specimen, but in *C. clavatus* they are yellow horn-color at the extremity.

It seems to me improbable that *Cariacus toltecus* (Saussure) is identical with *C. yucatanensis*, but rather with *C. sartorii* Sauss. (= *Coassus rufinus* B. & P). But of this I desire to treat in a subsequent article. At all events none of these nominal species appear to have any close relationship to our *C. clavatus.*

From the specimens in the National Museum it appears that the range of *C. clavatus* extends at least from the province of Tehuantepec, in Mexico, to Costa Rica; but its presence in Yucatan, British Honduras, and Nicaragua has not been ascertained. There are no specimens from the Pacific coast of Central America, and it is improbable that the species occurs there.

Measurements of two mounted skins of C. clavatus, in millimeters.

Catalogue No.	Locality.	Collector.	When collected.	Sex.	Height at shoulder.	Length of head.	Length of ear from behind.	Calcaneum to top of hoof.	Length of tail with hairs.	Top of front hoof to knee.	Depth of hind hoof in front.	Length of antler from behind.	Remarks.
16075	E. Honduras.	C. H. Townsend	1887	♂	732	246	130	312	239	199	37	88	Young.
16076	....do	....do	1887	♀	685	230	132	306	238	199	34	.....	Do.

Measurements of ten skulls of C. clavatus, in millimeters.

Catalogue number.	Locality.	Sex.	Greatest length of skull.	Basi-cranial length. (Hensel.)	Length of nasals.	Greatest width of skull (between lower rims of orbits.)	Length of orbit.	Height of orbit.	Length of upper tooth-row.	Length of lower tooth-row.	Tip of mandible to angle.	Angle to top of coronoid process.	Tip of intermaxillæ to end of palate.	Greatest breadth of posterior nares.	Greatest diameter of pedicel of antler.	Length of longest antler from behind.	Postero-superior rim of orbit to base of antler.
*13038	Costa Rica	♂	264	234	83	114	40	40	69	77	193	104	164	24.5	26	104	44.5
†14212	do	♂	255	225	77	106	42	42	59	77	194	101	155	25	21	100	45.0
†13040	do	♂	252	224	73	103	38	41	64	74	190	97	156	27	26	‡63	30.0
†[illegible]	do	♂	248	223	73	101	40	38.5	69	77	186	90	156	20	20	96	45.0
§22828	Eastern Honduras	♂	222	195	70	89	35	33	69	....	....	....	140	22	13	51	42.0
∥[illegible]	Mirador, Mexico	♂	193	166	53	83	33	31	51	55	140	71	114	21	10	....	42.0
†[illegible]	Costa Rica	♂	191	166	49	78	32	30	46	45	137	64	114	....	....	....	....
†13485	do	♀	226	202	62	89	35	37	69	77	173	88	145	21	....	....	....
§22829	Eastern Honduras	♀	215	194	66	85	33	35	69	76	171	86	140	22	....	....	....
*[illegible]	Costa Rica	♀	217	193	65	89	34	35	66	72	161	81	136	23	....	....	....

* J. C. Zeledon, collector.
† William M. Gabb, collector.
∥ Dr. C. Sartorius, collector.
§ C. H. Townsend, collector.
‡ Antlers diseased.

REVIEW OF JAPANESE BIRDS.

VIII.—THE NUTCRACKER (*NUCIFRAGA CARYOCATACTES MACRORHYNCHOS*).

BY LEONHARD STEJNEGER.

Having recently been asked by Victor Ritter von Tschusi-Schmidhoffen to express an opinion in regard to the races of *Nucifraga caryocatactes*, I shall not attempt a full analysis of the whole question, but only review the material in my hands, as it may throw some light on the subject.

Brehm was the first to clearly define the two races of Nutcrackers, which most ornithologists who have studied the question are now willing to admit. He was, however, unable to assign to them definite and distinct habitats, and partly because the shape of the bill, which is the principal characteristic of the two races, is in itself subject to great individual variation as well as to considerable changes on account of wear and tear, partly on account of the unreasonable prejudice of ornithologists concerning the forms described by Brehm, the races or subspecies in question were either misunderstood or entirely ignored for more than half a century. When, in 1872, I examined and measured a number of Nutcrackers in the museums of Bergen and Christiania for the monograph of von Tschusi-Schmidhoffen,* I labored under the same impression, viz, that because both thick-billed and slender-billed specimens occurred in Norway there could not well be any racial difference. But after the élaborate monograph of Dr. Rudolf Blasius,† in which he most convincingly demonstrates that the resident bird of Europe is the thick-billed form, while the slender-billed individuals belong to the numerous flocks which, with short and irregular intervals, invade the western countries from the forest region of Siberia, there is no excuse for confounding them any more.

Before proceeding any further it will now be necessary to ascertain the correct names of the two forms. While expressing my great appreciation of Dr. R. Blasius's painstaking work, I can not but most severely condemn that he should think it necessary to reject the old names for the trifling reason that they are unsuitable, and substitute new terms in direct violation of the law of priority recognized both by the code of the American Ornithologists' Union and by the Stricklandian code. The new names are imposed in order to avoid misunderstandings and confusions, but they have only made confusion more con-

---

* Der Tannenheher (*Nucifraga caryocatactes*). Dresden, 1873, p. 4.

† Der Wanderzug der Tannenheher, etc., Ornis, II, 1886, pp. 437–550, + pl. i–iii (also extr. paged 1–114).

founded. It is safe to say that if Dr. Blasius and von Tschusi had stuck to the old terms they would by this time have become familiar to all ornithologists. As it is the new names should be suppressed as soon as possible, before more mischief is done.

The following is a condensed, but correct and nearly complete synonomy of the two forms. It is plain that the resident form of Sweden, upon which Linnæus bestowed the name *Corvus caryocatactes* must stand as the typical form. The Thick-billed Nutcracker, therefore, is entitled to the name—

Nucifraga caryocatactes (LIN.).

1758.—*Corvus caryocatactes* LINN., Syst. Nat., 10 ed., I, p. 106.
1816.—*Caryocatactes maculatus* KOCH, Syst. Baier. Zool., I, p. 93.
1816.—*Nucifraga guttata* VIEILLOT, Nouv. Dict. d'Hist. Nat., V, p. 354.
1817.—*Caryocatactes nucifraga* NILSSON, Orn. Svec., I, p. 90.
1823.—*Nucifraga brachyrhynchos* BREHM, Lehrb. Eur. Vög., p. 104.
1833.—*Nucifraga platyrhynchos* BREHM, Isis, 1833, p. 970.
1855.—*Nucifraga alpestris* BREHM, Vogelf., p. 66.
1860.—*Nucifraga caryocatactes major* BREHM, Journ. f. Orn., 1860, p. 236.
1886.—*Nucifraga caryocatactes pachyrhynchus* R. BLASIUS, Ornis, II, p. 543; extr. p. 107; pl. ii, figs. 3, 4; pl. iii.

Should it be found necessary to use a trinominal in order to avoid mistakes it should be no other than *Nucifraga caryocatactes brachyrhynchos*. On the other hand, the Slender-billed Nutcracker should stand as—

Nucifraga caryocatactes macrorhynchos BREHM.

1823.—*Nucifraga macrorhynchos* BREHM, Lehrb. Eur. Vög., p. 103.
1833.—*Nucifraga hamata* BREHM, Isis, 1833, p. 970.
1845.—*Nucifraga caryocatactes* SELYS-LONGCH., Bull. Ac. Brux., XI (p. 298) (*part; nec* LINN.).
1855.—? *Nucifraga arquata* BREHM, Vogelf., p. 66.
1866.—*Nucifraga caryocatactes macrorhynchos* BREHM, Verz. Samml., p. 4.
1886.—*Nucifraga caryocatactes leptorhynchus* R. BLASIUS, Ornis, II, p. 543; extr. p. 107; pl. i; pl. ii, figs. 1, 2.

It appears that von Tschusi-Schmidhoffen, quite independently and about the same time, came to the same conclusions as Dr. R. Blasius,* and both these ornithologists agree in dividing the Nutcracker into two races—one western, thick-billed, and another eastern, slender-billed. According to them *N. caryocatactes brachyrhynchos* "breeds in the northern temperate zone of the western portion of the palæarctic region, viz, in the forests of Lapland, Scandinavia, the Baltic provinces of Russia, East Prussia, the Harz, the Riesengebirge (Böhmerwald), the Schwarzwald (Black Forest), the Carpathians (the mountains of Bosnia, Herzegovina, and Dalmatia), the whole extent of the Alps, and the Pyrenees." *N. c. macrorhynchos*, on the other hand, is stated to "breed in the northern temperate zone of the eastern portion of the palæarctic

*See "Verbr. und Zug d. Tannenhehers," Verhandl. k. k. zool.-bot. Ges. Wien, 1888, p. 488; extr. p. 82.

region, viz, in the forests of Asia, from Kamtschatka and Japan west to the Ural Mountains and the governments of Perm and Vologda in European Russia."

Mr. Henry Seebohm, in a paper "On the Arctic Form of the Nutcracker,"* has lately taken issue with Dr. R. Blasius in regard to the alleged distribution of the two forms, though agreeing with him in the general result, viz, the distinctness of the forms and the migrant into northern Europe being the slender-billed Siberian race. He contends that "there is not an Eastern and a Western form, * * * but an arctic and a temperate form. * * * The Siberian form appears sometimes to winter in north China as well as in southern and western Europe, but the Japanese form appears to be a resident, and to be, to all intents and purposes, identical with the resident form of Europe. The white spots, both on the upper and under parts and on the end of the tail-feathers, are rather more developed in the Japanese birds than in the resident European ones, but not so much so as in examples from Siberia."

My material is not sufficient to solve the puzzle entirely, but I think it is large enough to show that Mr. Seebohm's theory is not well founded. But before examining my material I must, from a general stand-point, protest against the terms "arctic form" and "temperate form," used by Mr. Seebohm. In the first place, the Nutcracker is not an "arctic" bird. In Europe it occurs, more or less, stationary from Spain (roughly, 42° north latitude†) to northern Norway (about 64° north latitude). In northwestern Russia the typical form hardly extends so far north, while farther east the slender-billed race is not known to occur north of 62° north latitude, and the southern limit of its breeding range in the Ural seems to be about 62° north latitude.‡ In Asia the latter has been found by Mr. Seebohm himself in the valley of the Yenisej as far north as 67°, though farther east it hardly exceeds the sixty-fourth degree of latitude. The southern limit of its breeding range in western Asia seems to be the Tian-Shan,§ consequently about 40° north latitude, while in the extreme East slender-billed birds have been found in summer at least as far south as 38° north latitude. It will be seen that the distribution of the Siberian form, on the whole, is not more arctic than its western representative, if we regard the latitudes alone. But the adjectives arctic, for the former, and temperate, for the latter, are not better founded if, by such a nomenclature, we would indicate the relative distribution of the two forms where their ranges meet, for there is

---

*Ibis, 1888, pp. 236–241.

†Blasius, as quoted above, states that it breeds in the Pyrenees, but according to Dr. Companyo, in Dresser's Birds of Europe, IV, p. 458, it is only a rare bird in the eastern Pyrenees, while Arévalo y Baca (Aves de España, Madrid, 1887, p. 260), expressly says that it occurs only accidentally in Spain. In Italy, according to Gigioli (Avif. Ital., 1886, p. 13) and Salvadori (Ucc. Ital., 1887, p. 189) the Nutcracker is stationary only in the Alps.

‡Nazarow, Rech. Zool. Steppes Kirguiz, 1886, p. 31.

§Zeverzow, Journ. f. Orn., 1875, p. 172.

no evidence that in any part of the whole palæarctic region breeding localities of the slender-billed race are situated north of those of the thick-billed form on approximately the same degree of longitude, unless Mr. Seebohm be correct in referring the Japanese specimens to the typical form.

In fact, this identification by Mr. Seebohm seems to be the only foundation for his theory of an arctic and a temperate race, as opposed to Blasius's of a western and eastern. Upon the proper reference of the Japanese specimens, therefore, hinges the whole question.

I have before me four examples from Japan, which I can compare with four from Korea, one from Kamtschatka, and a number of both forms from Europe. According both to Blasius and Seebohm, the slender-billed individuals from Western Europe are only immigrants from Siberia; they will consequently serve as well as specimens from the latter country.

Both Blasius and Seebohm lay considerable stress on the dimensions of the bills as indicating the subspecific difference. To a certain extent this is so, and an examination of the tables of measurements given below will therefore give some valuable hints as to the identity of the various individuals, but only if the specimens can be examined at the same time, for it is plain when inspecting a series of these birds that the peculiar *shape* of the bills in the two birds is of more importance than the length and the height. In the typical form the upper mandible is more swollen, the upper tomium more inflected, and the basal portion of the culmen straighter and more parallel with the commissure, while in the slender-billed form the upper tomium is hardly inflected at all, and the culmen tapers at once towards the tip from the frontal feathering. At the latter point the bills of both forms are nearly of the same height, and consequently Dr. Blasius's method of measuring the bills in the middle is more expressive than that of Mr. Seebohm, who measures them at the angle of the gonys. It is plain that this difference is easier to appreciate in the specimens than to express in words or condense into a satisfactory diagnosis, the more so since the bills in these birds are subject to considerable individual variation in all directions. I will also call attention to the fact that the bills of the resident birds of Europe seem to vary to some extent locally, as both Blasius and von Tschusi-Schmidhoffen have noted a difference in the stoutness of the bill in specimens from Sweden and from the Alps.

The other character to which Blasius has called special attention is the width of the terminal white band of the tail-feathers. In the typical form the average width is stated to be 18.3^{mm}, while in the slender-billed subspecies it is given as averaging 27.4^{mm} on the outer pair. The difference in the width of the white band is also admitted by Mr. Seebohm, and I find it corroborated by the material before me. I will remark, however, that this character is also subject to some individual variation, but, so far as I can make out, there is no local variation

within the two races. On the other hand, as in many other birds, the white ends to the tail-feathers are probably, on the whole, smaller in the young birds than in the old ones.

With these remarks in view, I shall now proceed to examine the material before me.

The first one is U. S. National Museum No. 110015, from Petropaulski, Kamtschatka, collected December 27, 1885. It is the easternmost example I have seen, and is a very pronounced slender-billed bird, agreeing closely with Blasius's fig. 2, pl. i. Its coloration exhibits the maximum amount of white, as might be expected.

Next comes four birds collected by Mr. P. L. Jouy, at Fusan, southern extremity of Korea (latitude 35°), the southernmost locality, I think, in which specimens of this species ever have been taken (U. S. National Museum, Nos. 114097–114100). They are all alike and very characteristically slender-billed, belonging undoubtedly to *macrorhynchos*, both on account of the shape and size of the bill and the width of the white tail-band. From Norway I have four slender-billed birds, evidently Siberian immigrants, collected near Bergen during the great invasion in 1887* (U. S. National Museum, Nos. 113218–113222), which are in every particular identical with the Korean examples. It would be utterly impossible to tell these birds apart were the labels removed, and the uniformity of these eight specimens of so variable a species, and from so distant localities, is truly astonishing.

Finally, I have four specimens from Japan, collected by Mr. Jouy, but as two of them are young birds which have not yet fully assumed the adult plumage, they may safely be left out of the comparison. The remaining two are U. S National Museum, No. 88701, ♀, Fuji, July 2, 1882, a fully adult bird, just molted into a fresh plumage, possibly the mother of the two young birds referred to, which were shot in the same locality on the same day, and the other, No. 91392, ♂, Tate-Yama, December 17, 1882. The latter is unquestionably a typically slender-billed bird, very much like the one described from Kamtschatka, with a slightly longer bill, the length of which exactly equals the average of the eight specimens from Korea and Norway referred to above, while the amount of white on the tail almost reaches the maximum. The bill is just a trifle higher than that of the other slender-billed specimens (though not reaching the maximum height of specimens measured by Blasius, *e. g.*, his

* I have seen only few notices of the 1887 migration. According to J. Collin, in his "Bidrag til Kundskaben om Danmarks Fuglefauna," the Nutcracker has never before occurred in such numbers in Denmark. In Norway the immigration was remarkable both on account of the number of birds and the extent of country covered, specimens having been taken even north of Tromsœ. Near Bergen about one hundred individuals were killed during September, and Mr. V. Storm states that the bird appeared in the vicinity of Trondhjem in vast numbers about the first of that month. Numerous specimens were received from Rœraas, Guldal, Œrkedal, Rissen, and more northern localities. (K. Norske Vid. Selsk. Skr. 1886–'87, Trondhj., 1888, p. 52; Naturen, XII, 1888, p. 224.)

Nos. 30, 31), but its shape is normal, and differs in that respect from the *resident* Scandinavian birds as much as any one in the series. The Fuji-Yama bird, found breeding near the extreme southern range of the species, differs only in having the bill shorter than any other specimen in the series. The shape, however, is that of *N. macrorhynchos*, and the white on the tail is almost up to the average, as established by Blasius, or 3^{mm} wider than the maximum of any specimen by him referred to the typical thick-billed form. That the shortness of the bill is no argument against referring this Japanese specimen to the Siberian form is very plain, from the fact that it is nearly identical with a Yenisej specimen collected by Mr. Seebohm himself (No. 176 of his collection, fide Blasius, Ornis, 1886, p. 472, extra p. 36, No. 8).*

My material, therefore, contradicts Mr. Seebohm's suggestion that the resident bird of Japan is, "to all intents and purposes, identical with the resident form of Europe." On the contrary, it is evident to me that it is, to all intents and purposes, identical with the Siberian, or the slender-billed form *N. c. macrorhynchos*.

The very meager *details* in regard to his specimens, which Mr. Seebohm furnishes in his article, do not support his own conclusion that "the white spots * * * on the ends of the tail-feathers are * * * not so much [developed] as in examples from Siberia;" for he himself gives the white on tail as varying between 0.9 and 1.1 inch in the Japanese birds, against a variation of from 0.8 to 1.25 inch in Siberian and Chinese specimens and presumed European migrants, consequently nearly coinciding with the limits established for the latter.

I am, therefore, forced to conclude that Dr. R. Blasius and V. von Tschusi-Schmidhoffen are right in distinguishing between an eastern and a western race, and that Mr. Seebohm is wrong in assuming the existence of an arctic and a temperate form of the Nutcracker.

Before closing I would say, however, that I will not deny the possibility of a large series of Japanese birds showing a somewhat shorter bill, on the average, than continental Asiatic specimens; but I will venture to say that the difference in size and shape will not be so great as it is between resident birds from Scandinavia and southern Europe, and I do not think that the differences will ever prove tangible or constant *enough* to allow a further subdivision of this species. Blasius and von Tschusi have made it pretty plain that the differences in size and shape of bill in the two subspecies recognized are due to the difference in the food, the nut of the Siberian form of *Pinus cembra* having a thinner shell than the typical form growing in the mountains of central Europe. The difference between resident Scandinavian and South European specimens is easily explained from a similar reason, as *Pinus*

*In the table alluded to the length of the bill is given as 30^{mm}. This I take to be a misprint or a slip of the pen for 40^{mm}, as the length from nostril to tip of bill is said to be 34.2^{mm}, exactly as in the Japanese specimen before me, the exposed culmen of which is 40^{mm}.

cembra does not occur wild in Scandinavia, where the Nutcrackers are compelled to live on seeds or nuts harder and more difficult to open. *Pinus cembra* is said to occur in the highest mountains of Hondo, Japan, but apparently in limited number. It is therefore doubtful whether the Nutcracker to any great extent feeds on this fruit. I am also unable to say whether the Japanese *P. cembra* belongs to a thin-shelled variety or to a thick-shelled, as I cannot find it stated whether the form occurring in Japan is *P. cembra sibirica* or not. It may be useful to remark, that Professor Schübeler (Die Pflanzenwelt Norwegens, Christiania, 1875, p. 154) characterizes the seeds of the two forms (or species?) as follows: *P. sibirica* having the seed sooty-brown in color, and rather attenuated in shape at one end, one hundred seeds weighing 24.75 grams, while those of *P. cembra typica* are light brown, oval or nearly globular, one hundred seeds weighing 39.10 grams. There are consequently three questions for the resident field ornithologists of Japan to solve: (1) Are the bills of the Nutcrackers residing in Japan normally and on the average shorter than the bills of the birds residing on the Asiatic main-land? (2) What kind of seed or nut forms the principal food of the Nutcracker in Japan? (3) Are the seeds of *Pinus cembra* in Japan incased in a harder shell than those from Siberia?

Measurements (in millimeters).

I. NUCIFRAGA MACRORHYNCHOS.

(a) Specimens from Japan.

U. S. Nat. Mus. No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Upper mandible beyond lower one.	Tarsus.	Middle toe with claw.	Height of bill in the middle.	White of outer tail-feathers.
88701	Jouy, 389	♀ ad.	Fuji, Japan	July 2, 1882	182	123	40	1	38	35	11	26
91392	P. L. Jouy, 879.	♂ ad.	Tate-Yama, Japan	Dec. 17, 1882	192	129	45	1	40	34	11	32

(b) Specimens from Continental Asia and Europe.

114097	P. L. Jouy, 1540.	♂ ad.	Fusan, Korea	Sept. 23, 1885	182	123	47	4.5	38	....	9	24
114098	P. L. Jouy, 1548.	♂ ad.	....do	Sept. 27, 1885	190	128	46	3	39	....	10	26
114100	P. L. Jouy, 1549.	♀ ad.	....do	Sept. 27, 1885	180	119	43	2	40	....	10	28
114099	P. L. Jouy, 1550.	♂	....do	Sept. 27, 1885	186	125	48	3	41	....	10.3	32
110015	Hunter	....	Petropaulski, Kamtschatka.	Dec 27, 1885	180	119	42	4	38	....	10	34
113218	Berg. Mus.	♂	Bergen, Norway	Sept. 18, 1887	180	120	43	2	39	34	9.5	22
113220	...do	♂	....do	Sept. 30, 1887	176	122	42	2	37	....	8.8	29
113221	...do	♀	....do	Sept. 18, 1887	182	129	45	1	41	....	10	25
113222	...do	♀	....do	Sept. 10, 1887	177	117	44	1	39	33	9.6	27

II. NUCIFRAGA CARYOCATACTES.

98573	Stejneger, 65.	♀ ad.	Christiania, Norway	Sept. 20, 1873	185	123	41	0	40	36	12	20
111106	Collett	♀ ad.	...do	Sept. 28, 1886	184	122	42	0	40	34	12	18
9673	Von Müller.	♂ ad.	Germany		193	122	47	2	....	....	11	20

THE SINGLE-HEADED DRUM OF THE NASKOPIE (NAGNAGNOT) INDIANS, UNGAVA DISTRICT, HUDSON BAY TERRITORY.

BY LUCIEN M. TURNER.

The drum used by the Naskopies differs from that of their neighbors and stock kindred, the East Main Indians, of the Fort George district.

The instrument employed by the Naskopies is a well-made, single-headed affair. The construction of each drum may differ in detail, but the general plan is preserved. The barrel is seldom more than four inches deep, covered by a reindeer skin. It is stretched over the barrel and held in position by a hoop one-fourth inch wide, and to this the membrane is stitched, so as to give uniform tension. This narrow hoop is placed upon the barrel edge, and a wider hoop, but slightly larger in diameter than the outer circumference of the barrel, is placed upon the narrow hoop inclosed by the edge of the membrane. Sufficient pressure is exerted to bring the membrane into proper tension, and then it is held in place by a system of thongs passing through holes pierced in the wide hoop and the lower edge of the barrel. The thongs pass diagonally through the pairs of holes, and by drawing on them the barrel and hoop may be approximated sufficiently to secure the desired tension of the membrane.

The outer side of the membrane (the side beaten upon) is crossed by a thong which passes through the barrel or quill end of four feathers of the wing of a Ptarmigan. A similar cord crosses the under side of the membrane, but at right angles to the one on the upper side, and it also contains four quills, pierced by the cord. The object of these cords, with their attachments, is to produce a reverberation of the sound.

The drum-stick used is a piece of antler fashioned so as to form a round but flat knob on a flattened strip or piece of the antler. A gun-cap box is often covered with a piece of deer-skin and fastened to a wooden handle, also covered with leather of the same kind, and used for a beating-stick. In the instances where such a box is used it frequently contains a few shot or fine gravels, which tend to create a rattling sound.

As the drum is never used outside of the tent, it is so prepared that it may be suspended. To effect this a double strand (two single strands) of sufficient length is affixed to any portion of the outside of the large hoop, and by means of the thongs the drum is suspended to the poles of the tent at a convenient height for the drummer. To the opposite side of the hoop is affixed a stout piece of buckskin, which is grasped in the left hand in order to steady the instrument.

The performer sits on the ground or on a skin with his legs projected. The left hand grasps the buckskin handle. A few drops of water are

Sept. 3, 1889.

sprinkled, by a dexterous flip of the fingers, on the head or membrane, in order to relax it, lest in its tense, dry condition it may burst under the severity of the blow.

The measure of the beat is two-fourths ($\frac{2}{4}$), or one two, one two, one two, the accent upon the latter.

The beating is always accompanied by words, either a monotonous chant of two syllables or else a disconnected recital of events; usually in relation to some particular occurrence, pertaining to the actions of man or beast.

The drum is used at all ceremonies, however insignificant may be the purpose for which it is beaten.

The conjurer employs it to succor the afflicted; to terrify the baneful spirits creating disquiet of mind; to regain the aid of rebellious spirits; to relieve the distress of want; to express his sorrow or joy. Scarcely a purpose, engendered for personal gratification, but it may be furthered by recourse to the drum.

When the hunters have been fortunate in the chase, good-will and plenty cheer the hearts of those people. The older men visit from tent to tent and recount the exploits of their younger days to the group of younger men who straggle in and become wrapt listeners to the recitals of the elders; good cheer is promoted by the drum enlivening the recitals interspersed with songs, and not until the gleam of the eastern dawn discloses the light of day do the listeners depart, one by one, to their places, while yet the drum beats long after slumber has fastened itself upon all but the narrator, who finds himself without an audience.

NOTES ON A COLLECTION OF FISHES FROM THE MAUMEE VALLEY, OHIO.

BY SETH E. MEEK.

The following paper is based upon a small collection of fishes made in Defiance County, Ohio, by the writer in July, 1887. Less than one day was spent in seining in each of the following localities: Maumee River and Gordon Creek, near Cecil; Gordon Creek, near Cicero; Lost Creek, about 2½ miles southwest of Farmer; and in Forlow's Pond, 2 miles southeast of Cicero. The seining was done with a small Baird seine.

The Maumee River flows through a nearly unbroken region, and with a sluggish current. Near Cecil, Ohio, the current is swifter than usual and the bottom of the river is sandy, or in a few places rocky.

Gordon Creek is a northern tributary of the Maumee River, and it empties into the river a short distance below Cecil. The creek is small, and in the summer it becomes nearly dry, with little or no running water in it.

Such was the case at the time of our visit, and so the seining was done in a few deep holes by the road side about 1 mile above its mouth.

Cicero is 10 or 12 miles farther up the creek. At this point the creek is little more than a small brook, with a muddy bottom, with occasional stretches of sand.

Lost Creek is also a northern tributary of the Maumee River. It is larger than Gordon Creek, its bottom being more sandy; and, as it is fed by springs in the upper part of its course, it is seldom, if ever, without running water.

A few miles below Farmer the creek formerly lost itself in a large marshy tract of land, which at that time was covered with a dense growth of underbrush. In later years the marsh has been cleared up, and the water conducted through it by means of a series of large ditches to the main channel of the creek below.

Forlow's Pond is an artificial pool, made in 1882 for a reservoir to supply water for the tile factory of Forlow & Co. The pond covers about one-half acre. During high water in the spring it is in communication for a short time by means of ditches with Gordon Creek; it is also fed by an artesian well throughout the year.

In former years a greater portion of Defiance County was very heavily timbered. In the low lands black ash and oak were the predominating trees, while on the upper lands oak, white ash, walnut, beech, and maple predominated. Within the past thirty years much of the land has been cleared up, while large tracts of woodland still remain, however much

depleted of its best timber, and the other timber has been injured more or less by occasional fires.

A portion of the collection of fishes obtained in the above-named localities has been sent to the U. S. National Museum and to the museum of Indiana State University. I am indebted to Dr. D. S. Jordan for various aids in the preparation of this paper.

1. **Amia calva** Linnaeus.
Dog-fish.

P.* Common in 1882; none taken in 1887.

2. **Ameiurus nebulosus** (Le Sueur). (U. S. Nat. Mus., Cat. No. 40093.)
Common Bull-head.

M., L., C., G., P. Very abundant.

3. **Ameiurus melas** (Rafinesque). (U. S. Nat. Mus., Cat. No. 40092.)

M., L., C., G., P. Found with the above; abundant.

4. **Catostomus teres** (Mitchill). (U. S. Nat. Mus., Cat. No. 40088.)
Common White Sucker.

M., L., C., G. Abundant.

5. **Catostomus nigricans** Le Sueur.
Hog-sucker.

M. Not abundant.

6. **Erimyzon sucetta** (Lacépède). (U. S. Nat. Mus., Cat. No. 40090.)
Chub-sucker.

L., C., G. Scarce.

7. **Moxostoma duquesnei** (Le Sueur). (U. S. Nat. Mus., Cat. No. 40099.)
Red-horse Sucker.

M., L., C., G. Abundant.

8. **Campostoma anomalum** (Rafinesque). (U. S. Nat. Mus., Cat. No. 40089.)
Stone-lugger.

C. Not very abundant.

9. **Chrosomus erythrogaster** (Rafinesque).
Red-bellied Minnow.

L. Scarce.

10. **Pimephales promelas** Rafinesque. (U. S. Nat. Mus., Cat. Nos. 40084 and 40103.)

L., C., G. Not abundant.

11. **Pimephales notatus** (Rafinesque). (U. S. Nat. Mus., Cat. Nos. 40085 and 40102.)

M., L., C., G. More abundant than the former.

12. **Notropis microstomus** (Rafinesque). (U. S. Nat. Mus., Cat. No. 40112.)
(*Hybopsis stramineus* Cope.)

M. Two specimens taken.

* The following abbreviations are used: M. Maumee River, near Cecil, Ohio. L. Lost Creek. P. Forlow's Pond. C. Gordon Creek, near Cecil, Ohio. G. Gordon Creek, near Cicero, Ohio.

13. Notropis volucella (Cope). (U. S. Nat. Mus., Cat. No. 40101.)

C. Not very abundant.

Length of longest specimen, 3 inches. Head 4 in the length of the body; depth, $4\frac{3}{5}$; dorsal rays, 8; anal rays, 8. Scales in the lateral line, 35 to 36.

Body elongate, slender, with the dorsal region little elevated. Snout blunt; mouth very small, its gape parallel with the axis of the body, end of maxillary reaching about two-thirds distance to vertical from anterior margin of the orbit.

Length of snout equal to diameter of the eye, $3\frac{1}{3}$ in the length of the head.

Origin of first dorsal ray midway between tip of snout and base of caudal fin; scales before the dorsal not crowded, 15 to 16 in a series. Tips of pectoral fins reaching nearly to base of ventrals; ventrals reaching anal.

Teeth 4–4, slightly hooked at the tips; edges crenate; preorbital bone large, vertical diameter two-thirds diameter of eye, horizontal diameter three-fourths diameter of eye.

No markings on the fins; a dark band on sides and around the snout the black on the snout on the upper jaw only.

This species differs from *Notropis microstomus* in having comparatively a smaller mouth, a more slender form, larger snout, higher fins, and a larger preorbital bone.

14. Notropis whipplei (Girard). (U. S. Nat. Mus., Cat. No. 40113).
Silver-fin.

M. L. Not abundant.

15. Notropis megalops (Rafinesque). (U. S. Nat. Mus., Cat. No. 40108.)
Common Shiner.

M., L., C., G., P. Very abundant.

16. Notropis lythurus Jordan and Gilbert.
Red-fin.

L., C., G., P. Scarce.

17. Notropis atherinoides (Rafinesque).

M. Scarce.

18. Ericymba buccata Cope. (U. S. Nat. Mus., Cat. No. 40105.)

L., C., G. Very abundant in L.; much less so in other localities.

19. Rhinichthys atronasus (Mitchill). (U. S. Nat. Mus., Cat. No. 40111.)
Dace.

L. Not abundant.

20. Hybopsis kentuckiensis (Rafinesque). (U. S. Nat. Mus., Cat. Nos. 40086 and 40096.)
Horny-head.

M., L., C., P. Abundant in all places except P.

21. Semotilus atromaculatus (Mitchill). (U. S. Nat. Mus., Cat. No. 40091.)
Chub; Horned Dace.

M., L., C., G., P. Abundant.

22. Opsopœodus emiliæ Hay.

Length of specimens, $2\frac{1}{4}$ inches; head, $4\frac{1}{4}$ in the length of the body; depth, $4\frac{1}{3}$. Dorsal, one short and nine long rays; anal, 1–8; scales, 40 in the lateral line.

Body elongate, not much compressed, rather robust anteriorly; caudal peduncle slender.

Snout bluntish; mouth very small and very oblique, its gape making an angle of at least 60° with the axis of the body. Lips very thin; chin convex and projecting beyond margin of the upper lip when the mouth is closed. Eye moderate; its diameter $3\frac{1}{6}$ in length of head. Length of snout, four-fifths diameter of the eye, end of the maxillary reaching about two-thirds to vertical from anterior margin of the orbit.

Origin of first dorsal ray nearer tip of snout than base of caudal fin by about diameter of the eye; first dorsal ray about one-half length third dorsal ray; second about three-fourths the length of the third. Length of longest dorsal ray, four-fifths length of the head, its tip reaching beyond tip of last ray when the fin is deflexed. Anal similar, but smaller. Tips of pectoral fins reaching two-thirds distance to base of ventrals; ventrals reaching vent, which is midway between base of pectoral and base of caudal fin. Caudal fin forked; outer rays more than twice length of inner rays.

Scales before dorsal fin not crowded, 16 in a series.

Teeth, 5–5, slightly hooked at tips, and with grinding surface and slightly crenated edges. Lateral line incomplete.

Straw-colored, with top of head black. The first five dorsal rays (including short one) black, next two rays white, and the last three black. All the other fins plain, with no dark markings.

The above description is taken from two specimens from Maumee River.

Dr. D. S. Jordan has compared these two specimens with the types of *O. emiliæ*, types of *Trychærodon megalops* Forbes, and with specimens from New Harmony, Ind., and furnishes me with the following notes: "The two specimens (Maumee) are larger and brighter in color than types of *O. emiliæ*; they are more compressed, brighter, and with slightly larger eye than *T. megalops*; they are also larger and have more black on the dorsal than the New Harmony specimens. All, however, seem to belong to one species."

23. Notemigonus chrysoleucus (Mitchill). (U. S. Nat. Mus., Cat. No. 40100.)

M., P. Not abundant.

24. **Dorosoma cepedianum** (Le Sueur). (U. S. Nat. Mus., Cat. No. 40106.)
Hickory Shad.

C. Rather abundant.

25. **Umbra limi** (Kirtland). (U. S. Nat. Mus., Cat. Nos. 40087 and 40110.)
Mud Minnow.

C., G., L. Rather common in small bayous.

26. **Lucius vermiculatus** (Le Sueur). (U. S. Nat. Mus., Cat. No. 40098.)
Little Pickerel.

C., L., P. Not very abundant.

27. **Anguilla anguilla rostrata** Le Sueur.
Eel.

Specimens of this species have been taken in the Maumee River; none seen by me in 1887.

28. **Labidesthes sicculus** Cope.

A few small specimens taken in the Maumee River.

29. **Apredoderus sayanus** (Gilliams). (U. S. Nat. Mus., Cat. No. 40104.)
Pirate Perch.

G. One small specimen taken.

30. **Ambloplites rupestris** (Rafinesque). (U. S. Nat. Mus., Cat. No. 40097.)
Rock Bass.

M. Not abundant.

31. **Lepomis cyanellus** Rafinesque. (U. S. Nat. Mus., Cat. Nos. 40083 and 40095.)
Sun-fish.

M., C., L., G., P. Abundant.

32. **Lepomis megalotis** (Rafinesque.) (U. S. Nat. Mus., Cat. No. 40094.)

M., L., P. Less abundant than the former.

33. **Micropterus dolomieu** Lacépède. (U. S. Nat. Mus., Cat. No. 40115.)
Small-mouthed Black Bass.

M. Two small specimens taken; not very abundant.

34. **Micropterus salmoides** Lacépède.
Large-mouthed Black Bass.

M. One specimen taken on a trout line. Both this and the former species are less common than formerly.

35. **Etheostoma pellucidum** (Baird). (U. S. Nat. Mus., Cat. No. 40114.)

Common in the river where the bottom is sandy.

36. **Etheostoma nigrum** Rafinesque. (U. S. Nat. Mus., Cat. Nos. 40082 and 40107.)

M., C., G., L. Abundant.

37. Etheostoma caprodes Rafinesque.

Log Perch.

M. One specimen taken.

38. Etheostoma aspro (Cope and Jordan). (U. S. Nat. Mus., Cat. No. 40081.)

Black-sided Darter.

M., C., L. Not abundant.

39. Etheostoma cœruleum Storer.

Rainbow Darter.

L. One specimen taken.

COE COLLEGE, CEDAR RAPIDS, IOWA, *January* 15, 1889.

DESCRIPTION OF NEW GENERA AND SPECIES OF FOSSILS FROM THE MIDDLE CAMBRIAN.

BY CHARLES D. WALCOTT.

In a collection of Middle Cambrian fossils, sent to me for study by Dr. Karl Rominger, I find several new forms, which he permits me to describe. With these, two other species are described—one collected by Dr. Cooper Curtice, in northern Georgia, and the other by me in Newfoundland.

It is my intention to fully illustrate the species described in this paper in a review of the Middle Cambrian fauna.

Lingulella mcconnelli n. sp.

Shell subspatulate, height and breadth as 7 to 4½. Ventral valve subattenuate towards the apex, broadest midway, with the sides converging slightly towards the front and rather rapidly towards the apex; front broadly rounded. Dorsal valve short, height and breadth subequal; the broad front is squarely rounded, and the apex broadly rounded.

The specimens are somewhat flattened in the shale, but the rather strong shell preserves a moderate convexity. Surface marked by concentric striæ of growth and radiating longitudinal lines.

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus zone, Mt. Stephen section, British Columbia. Collection of Dr. Karl Rominger.

Crania (?) columbiana n. sp.

Shell small, circular or slightly longer than wide; apex central or nearly so. Surface marked by fine costæ that radiate from the apex to the margin. Traces of fine spines appear about the margin. Diameter 2^{mm}.

The generic reference is made on account of the surface characters being more like those of shells referred to Crania than to those of other genera: *Crania grayi* Davidson, *Crania lælia* Hall (24th Rep. N. Y. State Cab. Nat. Hist., p. 220, pl. 7, fig. 16).

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus zone, Mt. Stephen section, British Columbia. Collection of Dr. Karl Rominger.

Acrotreta gemma var. depressa n. var.

The specimens from Mt. Stephen are relatively much lower and broader in proportion to the height than the typical forms of *A. gemma*. On this account they are considered as a variety.

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus horizon, Mt. Stephen section, British Columbia. Collection of Dr. Karl Rominger.

Linnarssonia sagittalis Salter (sp.).

A beautifully preserved interior of the dorsal valve of this species came from the same locality as the preceding species.

Orthisina alberta n. sp.

Shell transversely suboval, front broadly rounded; the straight hinge line is shorter than the full breadth of the valve; area of the central valve high, bent backward from the hinge line, divided by a large foramen that is covered by a convex deltidium. The area of the dorsal valve slopes back at about a right angle to the valve. The broad, short foramen appears to have been covered by a low deltidium.

Surface marked by radiating costæ, five in a distance of 3^{mm} on the frontal margin.

This species recalls *Orthis lindstromi* Linnarsson, from the Paradoxides zone of Sweden.

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus zone, Mt. Stephen section, British Columbia. Collection of Dr. Karl Rominger.

Platyceras romingeri n. sp.

Shell small, apex incurved, body whorl expanding rapidly on the outer half of the volution; dorsum broad, subangular (?) on the right side; left side concealed in the matrix. The body volution is marked by concentric undulations, aperture and peristome broken. Surface marked by concentric striæ of growth. A second specimen, that is pressed flat in the shale, shows the outer volution quite regularly rounded, the aperture subcircular and the peristome smooth.

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus zone, Mt. Stephen section, British Columbia. Collection of Dr. Karl Rominger.

The Genus OLENOIDES Meek.

It is unfortunate that genera occurring in the three divisions of the Cambrian system have names so liable to be confused; viz, Olenus, Olenellus, and Olenoides. Olenus and Olenellus are respectively typical genera of the Upper and Lower Cambrian, and Olenoides attains its greatest development in the Middle Cambrian, in areas where the characteristic Atlantic province genus Paradoxides is absent. All three of the names have been used in published memoirs, and students will be obliged to distinguish them despite of their similarity.

The genus Olenoides was proposed by Mr. B. F. Meek[1] for a species which he provisionally referred to the genus Paradoxides—*P.*(?) *nevadensis*. In the description of the Middle Cambrian fauna[2] the type specimen

[1] Geol. Expl. Fortieth Par., vol. iv, pt. 1, p. 25.

[2] Bull. U. S. Geol. Survey, No. 30, p. 180, 1886.

is illustrated and other species referred to the genus, some of which were subsequently separated and placed under the genus Zacanthoides.[1] I mentioned, when the latter name was proposed, that Dorypyge, Dames was congeneric with Olenoides of Meek. Before I had met with the proposed name Olenoides, I had given a provisional generic name in manuscript to the group of species which were subsequently placed under Olenoides, in 1886.[2] This was before I knew of the proposed genus Dorypyge, although the latter was published in 1883.[3]

A comparison of the figures illustrating the type of the genus Dorypyge, *D. richthofeni*,[4] with *Olenoides nevadensis*, *O. quadriceps*,[5] *O. wasatchensis*, and *O. curticei*, shows that they are congeneric, although the surface of *D. richthofeni* is granulated and the test of the other species is very thin and smooth, as far as known.

The species included under the genus are *Olenoides nevadensis* Meek, *O. quadriceps* H. & W., *D. wahsatchensis* H. & W. *O. curticei* n. sp., *O. marcoui* Whitfield, an undescribed species from northern Arizona, and one from the Coosa Valley, Alabama. Of the seven species *O. marcoui* and *O. quadriceps* are in association with the genus Olenellus. The undescribed species from Arizona is from strata high up in the Cambrian, and the remaining four are from strata between the Lower Cambrian or Olenellus zone and the Upper Cambrian or Dicellocephalus (Olenus) zone.

Olenoides nevadensis Meek.

Paradoxides? nevadensis Meek, 1870. Proc. Acad. Nat. Sci. Phil. vol., xxii, p. 62; *idem*, 1877. Geol. Expl. Fortieth Par., vol. iv, p. 23, pl. 1, fig. 5.

Olenoides nevadensis Walcott. Bull. U. S. Geol. Survey, No. 30, p. 181, pl. xxv, fig. 7, 1886.

The type specimen was found in a bluish-gray calcareous shale, at Antelope Spring in the House Range of western Utah. Mr. McConnell, Mr. Otto J. Klotz, and Dr. Rominger collected the species from a bluish-gray calcareous shale at Mt. Stephen, in the Rocky Mountains of British Columbia, on the line of the Canadian Pacific Railway.

Olenoides curticei n. sp.

This is a large, fine species that approaches *O. nevadensis* in its general characters, and differs in the details of the head and pygidium, as shown in the accompanying figure.

O. curticei was collected by Dr. Cooper Curtice in the Cambrian

[1] Am. Jour. Sci., 3d ser., vol. xxxvi, p. 165, 1888.

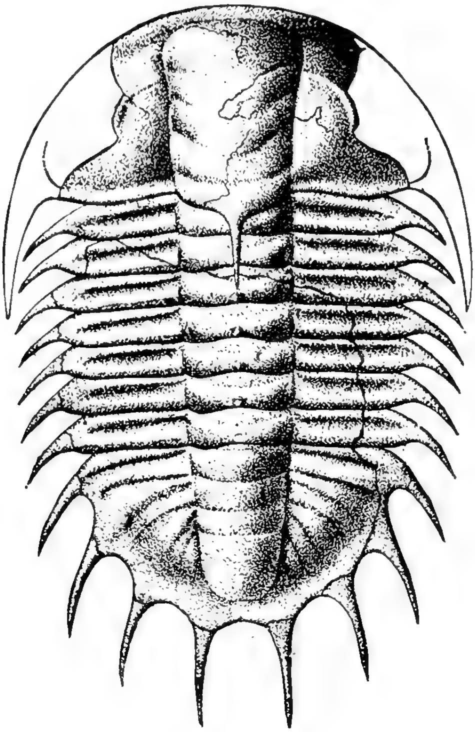
[2] Bull. U. S. Geol. Survey, No. 30, p. 181, 1886.

[3] China, Richthofen, vol. iv, p. 24. The work containing it was not accessible to me until late in the year 1885, after the text of Bulletin No. 30 had been printed (Bull. U. S. Geol. Survey, No. 30, p. 221, 1886).

[4] China, Richthofen, taf. 1 figs. 1a–6.

[5] Bull. U. S. Geol. Survey, No. 30, pl. xxix, figs. 1–c.

shales of Coosa Valley, near Blaine post-office, Cherokee County, Ala., where it occurs on the surface of dark flint nodules.



Olenoides curticei.

Olenoides sp. undet.

A second species of Olenoides was found by Dr. Curtice in an argillaceous shale, on the Edward's farm, near Craig's Mountain, Cherokee County, Ala. It differs, in the parts available for comparison, from *O. curticei* in having a larger number of spines on the margin of the pygidium, and the postero-lateral limb of the head is shorter back of the eye.

The pygidium is much like that of *O. nevadensis*, but, until more perfect specimens are obtained, I will not attempt to name or compare the species.

The associated fossils are Lingulella (?), Acrotreta, Scenella, Stenotheca, Hyolithes, and Ptychoparia three sp., etc.

Karlia n. gen.

Form elongate-oval, convex. Head longitudinally semicircular, deeply marked by the dorsal furrows. Glabella clavate, broadly expanded in front, with or without faint glabellar furrows. Occipital furrow well defined. Fixed cheeks subtriangular; posterior furrow broad; eye lobe small; free cheeks narrow. Hypostoma with a thick, rounded anterior margin that is extended into the large lateral wings, the sides of which extend one-half way back on the oval, convex body; posterior

marginal rim strong and separated from the body by a well defined sulcus.

Thorax with seven segments; axis with a central spine on each segment; pleural lobes with a broad groove; anterior lateral ends of pleuræ faceted.

Pygidium short, transverse, four to five segments in the axis, lateral lobes slightly grooved.

Surface granulose.

Types: *Karlia minor* and *K. stephenensis*. Generic name proposed in honor of Dr. Karl Rominger.

Karlia minor n. sp.

Form elongate-oval, convex. Average size, 7^{mm} in length by 3^{mm} in breadth. Head longitudinally semicircular, convex; frontal rim a narrow margin which passes into a stronger rim on the sides. Glabella clavate, expanding from the base to twice the width in front, marked by four pairs of short, faint glabellar furrows; occipital furrow deep; occipital ring strong and with a sharp, slight node at the center. The broad, deep, dorsal furrows unite with the posterior furrows to separate the strongly convex, subtriangular fixed cheeks; eye lobe short, narrow, and defined by a well-marked groove from the cheek; the groove extends forward to the dorsal furrow. Free cheeks narrow; marginal rim round and strong; posterior angle pointed, but not known to be extended into a spine.

Thorax with seven segments; median lobe convex and with a very short node or spine at the center of each segment; pleural lobes flat to the geniculation of the pleuræ, where the outer half of the segments are bent obliquely downward and slightly backward; pleural groove the full width of the segment to the geniculation, where it abruptly tapers to a point by the cutting in of the facet on the anterior side of the segment.

Pygidium of medium size, transversely semicircular; axis convex and crossed by three or four rings and the terminal lobe; the rings are extended out on the lateral lobes as broad, low ridges trending obliquely backward to the rounded margin.

Surface of the head granulated; thorax and pygidium apparently smooth.

All the specimens seen are small, none exceeding 10^{mm} in length.

Formation and locality: Middle Cambrian; Manuel's Brook, Conception Bay, Newfoundland. This species is associated with *Microdiscus punctatus*, *Paradoxides davidis*, etc.

Karlia stephenensis n. sp.

Menocephalus salteri (?) Rominger, 1887. Proc. Acad. Nat. Sci. Phila., pt. 1, p. 16 pl. i, fig. 6.

This species differs from the *K. minor* in its greater size, 40^{mm} in length by 30^{mm} in breadth; the fixed cheeks are wider and the grooves

on the pleuræ are narrower. In one of the large specimens the surface of the glabella is covered with fine, irregular elevated striæ.

Through the kindness of Dr. Karl Rominger I have the opportunity of studying this species.

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus zone, in the Mt. Stephen section, British Columbia.

Bathyuriscus (Kootenia) dawsoni n. sp.

Bathyurus (?) Rominger 1887. Proc. Acad. Nat. Sci. Phila., pt. 1, p. 18, pl. i, fig. 8.

General form ovate, broadest across the back of the head, strongly trilobed, although flattened in the shale. Head broad, semicircular in outline. Glabella broadly rounded in front; sides subparallel; surface convex and not showing any lateral furrows; occipital furrow and ring well defined. Frontal rim very narrow. Fixed cheek broad, and crossed by a narrow ocular ridge that extends obliquely forward from the eye to near the anterior angle of the glabella; postero lateral limbs large, subtriangular; anterior lateral limb short. Eye lobe small. Free cheeks unknown.

Thorax with seven segments; median lobe convex and with a spine at the center of each segment; pleuræ flattened two thirds of their length and then bend downward and outward to their rounded ends; pleural grooves broad to the point of tapering from the geniculation outward; anterior lateral facet slightly developed.

Pygidium large; median lobe prominent and extending the entire length to the posterior margin; it is crossed by fine rings that have a spine at the center of each; the terminal ring is short; lateral lobes with four anchylosed segments, distinctly outlined; margin narrow.

This species is a link between the genera Protypus and Asaphiscus. It has the type of head of the former and the thorax and pygidium of the latter.

The subgeneric name, Kootenia, will probably be raised to a genus in a final report. The specific name is given in honor of Dr. George M. Dawson, of the geological survey of Canada.

Formation and locality: Middle Cambrian, 2,000 feet above the Olenellus horizon, Mt. Stephen section, British Columbia. Collection of Dr. Karl Rominger.

Ogygopsis n. gen.

This genus is founded on the species *Ogygia klotzi* Rominger.[1] It differs from Ogygia in having a well-defined ocular ridge and in the narrow palpebral lobe. In other respects it is identical with Ogygia, as represented by *O. buchi*.

[1] Proc. Acad. Nat. Sci. Phila., pt. 1, 1887, pp. 12, 13, pl. i, fig. 1.

A SIMPLE METHOD OF MEASURING THE THICKNESS OF INCLINED STRATA.*

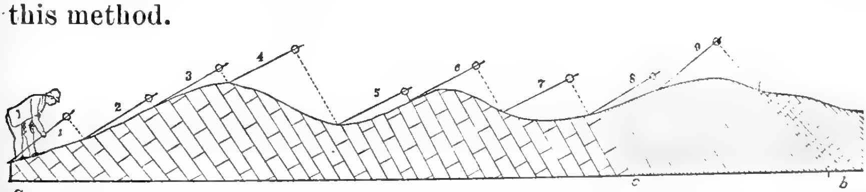
BY CHARLES D. WALCOTT.

When I began the study of the highly-inclined strata in Washington County, N. Y., during the field season of 1886, I found it necessary to measure the thickness of several sections where the surface was irregular, and the outcroppings of the strata numerous, though not continuous on the direct line of the sections.

Having used the Locke level in measuring horizontal strata, taking the distance from the ground to the eye as the unit of measurement, it occurred to me to substitute a clinometer compass for the level, and a rod, instead of my body, for the unit of measure. The compass was securely fastened to a light rod, so that the sights were on a level with the eye when the rod was standing upright and resting on the ground, and the clinometer needle at zero. The strata, in the section to be measured, were inclined to the east 40°. Placing the lower end of the rod at the base of the section, I inclined the rod towards the edges of, and at a right angle to, the line of the dip of the strata, which was indicated by the needle of the clinometer standing at 40°. Then, looking through the compass sights, the point where the line of sight touched the ground was marked as the next station for the rod, and on this station the base of the rod was placed for the second sight, which was made exactly as in the first instance, and so on to the end of the section. Frequent trials were made, at the exposed outcrops, to determine the angle of dip of the strata, so that the rod might be held at a right angle to it. In one section of curved strata, on the mountain side, the lower beds were horizontal whilst the upper beds dipped at an angle of 70°. By taking into account the angle of dip of the strata, at each of the measurements with the rod, so as to find the true line of sight (which is the angle of the dip of the strata), the thickness of the section was quickly determined.

Each individual who attempts to measure strata in the manner described should have the compass placed upon the rod just high enough to bring the sights on a level with the eye, the compass being so attached that when the rod is perpendicular the clinometer needle will point to zero.

The accompanying sketch illustrates the manner of measuring strata by this method.



* Read before the American Society of Naturalists, at New Haven, December 29, 1887.

In the sketch the dip of the strata is 54° to 65°, and the inclination of the rod from the vertical the same, from the horizontal it is 36° to 25°.

The total thickness of the strata between the points *a* and *b* is equal to the sum of the nine measurements. If, as is the case with myself, the compass sight be 5 feet 8 inches from the base of the rod, it is 9 times 5 feet 8 inches, or 51 feet for the entire thickness, or 39 feet 8 inches for the limestone and 11 feet 4 inches for the shale from *c* to *b*.

The method of measurement is simple, and always available when a suitable stick of sufficient length can be obtained for holding the compass. It saves time and is sufficiently accurate for most field-work. If a Locke level is also carried by the geologist, to be used in measurements of horizontal strata, he can measure strata of any degree of dip, and know, after once passing over the section, very nearly the exact thickness, on the spot, without an elaborate series of measurements and calculations, as he has only to multiply the number of measurements made by the distance between the base of the rod and the sights of the compass, or, if measuring horizontal strata, the sight of the Locke level. I have used this method during two field seasons and find it the most satisfactory of any known to me.

NOTES ON SOME INDIAN TERRITORY LAND AND FRESH-WATER SHELLS.

BY CHAS. TORREY SIMPSON.

The shells upon which the following notes are based were collected by the writer during a brief visit to the eastern portion of the Territory in the spring of 1888. On account of business, but a small portion of the two weeks I was in the "Nation" was spent in collecting. The reason for finding so few fresh-water species was the excessive amount of rain that fell just at the time of my arrival, which so raised the streams and ponds that for the most part I could obtain nothing.

Several very dry seasons had occurred previous to my visit, and as forest and prairie fires had raged with great violence I found in many places, and of several species, only dead shells. Most of the species enumerated have passed under the hands of Drs. Dall and Stearns of the U. S. National Museum, and I give the names of such just as they were given by them.

Helix (Triodopsis) copei Wetherby.

Under sandstone rocks; mountains near McAllister. Mostly dead, having been destroyed by forest fires.

? Helix (Triodopsis) vultuosa Gould.

Near Eufaula. A few specimens. Possibly a form of *H. copei*, as the two species seem to be quite close.

? Helix (Triodopsis) inflecta Say.

Abundant at Fort Gibson, Limestone Gap, and Eufaula.

Helix (Patula) alternata Say.

Fort Gibson. The strongly ribbed variety.

Helix (Polygyra) jacksoni Bland.

On limestone mountains near Fort Gibson. Very abundant. Limestone Gap, a few specimens. Several thousand shells of this species were found, and, with a half dozen exceptions, were much larger than the measurements given in Binney's Manual of American Land Shells. The greater diameter averaged 10, lesser 9^{mm}; height 5^{mm}. A few specimens were found in and near Fort Gibson measuring 7^{mm} greater diameter.

A form was found abundantly near Fort Gibson which differs remarkably from the type. Instead of the bicrural tooth on the body whorl at the aperture there is a heavy elevated deltoid callus, which is joined to the upper and lower margins of the peristome, and which occupies about the same area as the tooth in the type. The number of whorls is 5; greater diameter 7, lesser 6^{mm}; height, 3^{mm}. In examining

Sept. 3, 1889.

several hundred specimens, I have found none which approach the type, and I would therefore propose for it the varietal name of *deltoidea*.

Helix (Polygyra) dorfeuilliana Lea.

Fort Gibson; Limestone Gap; Eufaula. Abundant and variable in size.

Helix (Polygyra) triodontoides Bland.

A few dead specimens were found at Eufaula and near Kiowa. This species seems to me like a somewhat elevated and thinner form of *P. texasiana*.

Helix (Polygyra) texasiana Moricand.

Two or three dead and bleached shells were found near Eufaula.

Helix (Polygyra) leporina Gould.

Fort Gibson; Eufaula; Limestone Gap. Not abundant. Some of the specimens of this species strikingly resemble the Stenotremas, and I have received specimens from Texas, from an excellent American conchologist, labeled "*Stenotrema hirsuta*, small variety."

Helix (Stenotrema) monodon Rackett.

Rather plentiful near Limestone Gap and Eufaula. A form of this was found at the former place with spire greatly elevated, resembling *S. edwardsi*.

Helix (Stenotrema) stenotrema Ferussac.

Fort Gibson.

Helix (Mesodon) albolabris Say.

Fort Gibson; Limestone Gap.

Helix (Mesodon) elevata Say.

Near Fort Gibson.

Helix (Mesodon) thyroides Say.

Near Fort Gibson. The form *H. bucculenta*, with many variations, was found with the type. Some of these with a parietal tooth and others without; a number of them very closely approaching *Mesodon clausa* in size and appearance.

Helix (Mesodon) divesta Gould.

A few specimens at Fort Gibson. Abundant, mostly dead, near Eufaula and at Limestone Gap. Quite variable in size, ranging from 15^{mm} to 20^{mm} in diameter.

Helix (Mesodon) kiowaënsis n. s.

Shell umbilicated, orbicularly depressed, solid, dark-brown in color; whorls 5, with numerous rather coarse striæ, and fine revolving impressed lines, which are much more conspicuous on the last whorl. Suture deeply impressed, leaving the whorls well rounded; aperture oblique, somewhat transversely rounded, forming fully three-fourths of a circle; peristome thick and solid, white or purplish, evenly reflected

with a slight constriction behind it; umbilicus moderate, deep, exhibiting but little more than one of the whorls. Greater diameter 15, lesser 13^{mm}; height, 7^{mm}. Kiowa Station, about thirty specimens, mostly dead. Limestone Gap, two dead specimens. Another badly bleached shell was obtained not far from Eufaula.

Dr. R. E. C. Stearns considers this as a close ally of some of the smaller forms of *M. thyroides.* It seems to me to be more nearly related to *M. sayi.* Its wider umbilicus, more transverse aperture, solider texture, and less elevation distinguish it from *thyroides;* it is more depressed and has a more transverse aperture and narrower umbilicus than any forms of *sayi* I have seen, and its soft parts differ essentially from those of either. According to Mr. Pilsbry the jaw has 9 ribs (*sayi* having 13 to 16 and *thyroides* 13), the teeth have fewer laterals than *sayi*, and the inner cusp is bifid on the marginals, while in *sayi* it is entire.

Helicodiscus fimbriatus Wetherby.

A small variety wanting the epidermal fringe, and nearly destitute of the revolving ridges described by its author. Thousands of specimens were found, mostly dead, under slabs of sandstone on the mountains near Fort Gibson, and a few were taken at Limestone Gap. So far as I know, this is an entirely new locality for this species, as it has been credited heretofore only to the Cumberland subregion. I believe that a careful search throughout the Ozark Mountains and northern Texas will discover most of the species that have hitherto been supposed to belong only to the Appalachian chain. Most of the specimens found measured only from 3 to 4 ^{mm} in diameter.

Helicodiscus lineatus Say.

Fort Gibson; Limestone Gap.

Selenites concava Say.

Fort Gibson, a few shells.

Zonites friabilis W. G. Binney.

Abundant on limestone mountains near Fort Gibson and Tahlequah, and remarkably dark colored.

Zonites ligerus Say.

Fort Gibson.

Zonites acerra Lewis.

Low wet woods, Fort Gibson, with *Zonites ligerus*, *Triodopsis inflecta*, and the ribbed variety of *Patula attenuata.* Binney makes this merely a variety of *Zonites demissus*, but unless there are forms that connect the two it seems to me to be as distinct as most of the species of *Zonites.*

Zonites arboreus Say.

Eufaula.

Zonites radiatulus Alder.

Limestone Gap.

Zonites nitidus Müller.

A specimen of this species, somewhat smaller than the type, was found at Limestone Gap.

Zonites placentula Shuttleworth.

Fort Gibson, two or three shells.

Zonites capsella Gould.

A number of specimens were found at Limestone Gap, which Messrs. Dall and Stearns pronounce this species. The base is greatly flattened, as well as the upper part of the last whorl, giving the aperture a remarkably triangular form, quite different from any figures or specimens of *capsella* I have seen. One or two specimens of the typical *capsella*, were found with the above.

Helix (Strobila) labyrinthica Say.

Limestone Gap.

Pupa armifera Say.

Eufaula.

Pupa rupicola Say.

Fort Gibson.

Bulimulus dealbatus Say.

Fort Gibson, on limestone mountains; Limestone Gap. Abundant in both localities. I have no hesitation in saying that I believe *Bulimulus dealbatus* (Say), *B. schiedeanus* (Pfr.), and var. *Mooreanus* (Pfr.), and *B. alternatus* (Say) are merely varying forms of one and the same species. There is not a character given in the figures or descriptions of these shells that holds good when an extensive series from different localities is examined. I have before me several hundreds of specimens from Tennessee, Indian Territory, Kentucky, Texas, and Mexico, and I know whereof I speak. Say states that "the labrum of *alternatus* is white within, with a perlaceous tinge." W. G. Binney says that "the aperture is always dark; that it is readily distinguished from the allied forms by its greater solidity, its highly polished surface, its more elongated form, its dark-colored aperture bordered with the white internal margin of the peristome, and the tooth like callus upon the upper portion of the columella." (Manual of American Land Shells, page 371.) In a suite of sixty specimens from Derby and Laredo, Tex., there is a variation in the color of apertures and interiors from creamy white throughout through shades of light and dark brown to bluish black; there are shells with a greatly thickened rib on the inner submargin, a character that gradually fades out until specimens are found in which it is totally wanting; there is every possible variation of solidity, size, and form, as well as of comparative smoothness of exterior. Some of these might be considered forms of *dealbatus;* others perhaps would be referred to *alternatus* or *schiedeanus*, but many of them blend the characters of these so-called species in such a

manner that it is absolutely impossible to assign them to any species. The Derby specimens as a rule are smaller, less solid, and duller colored than those from Laredo, or from different points in Mexico. Specimens from Lee County, Texas, are very ventricose, rather thin, and covered with a loose, shaggy epidermis. Some of the Indian Territory shells show the tooth on the columella; in others it is wholly wanting. There are specimens in the lot from Derby having much the color of *schiedeanus* var. *mooreanus*, but which are longitudinally striped, and have dark purplish brown interiors. The variation in the length of specimens in my suite is from 16 to 33^{mm}, the larger specimens being from Mexico. I believe that the metropolis of this shell is Mexico, where it is larger, solider, smoother, and more highly colored than farther north; that in its northern limit—the Ozark and Cumberland Mountains—it is usually smaller, thinner, and less developed in every way than farther south. I will add that Dr. J. A. Singley, of Giddings, Tex., a man of much experience as a collector and a careful student, fully agrees with me in the above conclusions.

Succinea grosvenori Lea.

Fort Gibson, along a little stream in the town.

These shells agree perfectly with figure and description in Binney's Manual of American Land Shells, page 344, but I can not see that they differ essentially from *S. luteola* (Gould), which I found in great quantities in southern Florida and in western Nebraska. The western Nebraska shells are a trifle less inflated, and perhaps a little duller in color than those from Fort Gibson. The Succineas of the United States seem to be in a good deal of confusion and are troubled with a great many names, and when extensive suites from all over the country are carefully studied, I have no doubt that the number of so called species will be greatly reduced.

Helicina tropica Jan.

The form of *H. orbiculata* called by this name was found abundantly at Fort Gibson and near Stringtown.

Physa heterostropha Say.

McAllister; Fort Gibson.

Planorbis trivolvis Say

McAllister; Vinita.

Sphærium contractum Prime.

Pond at McAllister; Cabin Creek, Vinita.

Sphærium stamineum Conrad.

Cabin Creek, Vinita.

Unio camptodon Say.

Pond at McAllister.

Unio rutersvillensis Lea.

Pond at McAllister: Limestone Creek, at Limestone Gap. A small, dark, rough form, resembling somewhat *Unio texasensis*, was found in Cabin Creek, Vinita.

Unio luteolus Lea.

Limestone Creek.

Unio purpuratus Lamark.

Limestone Creek.

Unio parvus Say.

Cabin Creek.

Anodonta imbecillis Say.

Limestone Creek.

Anodonta dejecta Lewis.

Two specimens were found in Limestone Creek which are probably this.

NOTES ON HYDROCOTYLE AMERICANA L.

BY THEODOR HOLM.

(With Plates XLVI, XLVII.)

INTRODUCTION.

It is the intention to present, under the title "Notes," a series of contributions to the life-history of some North American plants; their manner of growth, illustrated by morphological representations of the differences in the development of their rhizomes, stems, etc.; their germination, and, finally, remarks upon their anatomical structure. But it is to be remarked that it would be difficult to give notes of this kind in anything like a systematic order, since the observations are usually made incidentally and at different seasons of the year. I hope, however, to be able to give these notes in such a manner as to give a more or less complete idea of some of our more interesting plants, whose development and structure has either not been described or is only briefly alluded to in the systematic works.

There are many circumstances in the life-history of our plants which are imperfectly known, and, although they may seem to be of little interest, they nevertheless have a certain value for the complete understanding of the organization of the plants, and therefore I do not hesitate to publish these observations under the title "Notes." Furthermore, the differences in the development of the organs may often show several good characters, which ought to be given in the diagnosis of the plants, especially when they admit the distinguishing of otherwise nearly allied species.

Purely systematic studies have furnished many excellent contributions to the knowledge of our flora; the distribution of plants, their different stations, their liability to variation, etc.; but it seems more than probable that had botanists given more attention to observations of this kind, and especially to the germination of the plants, a subject that has been much neglected, we should have a better knowledge of the complete life history of our plants, and the systematic studies would at the same time be rendered valuable assistance.

HYDROCOTYLE AMERICANA L.

During a collecting trip this fall in the woods along the Eastern Branch of the Potomac, Prof. Lester F. Ward, who has kindly shown me the most interesting localities in the vicinity of Washington, called my attention to *Hydrocotyle Americana*, which we found growing in

a moist, shaded place, and which, he informed me, he had collected several years ago, observing at the time some peculiar organs, apparently small tubers, which evidently belonged to the plant. He was unable to find descriptions of these organs in the systematic works, and as he was unable to undertake their examination himself he requested me to investigate them. The plants, on being carefully dug up, showed a number of tubers, hanging by whitish stolons from the axils of the lower leaves. I examined them, and found that the organs were true tubers, each consisting of several nodes, and that they must undoubtedly be of considerable importance for the propagation of the plant.

In presenting the results of this examination, I shall first make some remarks upon the diagnosis of our plant by the different authors who have described it. The presence of the tubers has been mentioned recently by Dr. George Vasey,* who observed them in 1886 and published a short note upon them, in which, however, he only mentions their presence. He says: "I was surprised to see a number of whitish threads hanging from the axils of the lower leaves. I found that near the extremity of these was a short oblong or cylindrical tuber, and these tubers were undoubtedly for the propagation of the plants." Dr. Vasey also sent the plants to Dr. Asa Gray, who replied that he had often observed the "threads," but never the tubers.

It seemed somewhat singular that this plant, one of our more common species, should never have been more carefully examined before and the presence of these tubers detected, and I determined to look at the descriptions of it in the systematic works. In Gray's Manual of Botany, 1870, the plant is described as having the "stems filiform, branching, spreading, and creeping," but the author says nothing in regard to its subterranean organs, either of the root or of the presence of any rhizome, and I found the same to be the case in some other systematic works of a more recent date. On turning to the older authors, curiously enough it is found that the fact of our plant being "tuberiferous" was mentioned more than eighty years ago by a French author, and in such a manner that it can not be doubted that he had examined the plant and found at least one tuber. This author is A. Michaux, who in his Flora Boreali Americana, published in the year 1803, has written in his diagnosis of *Hydrocotyle Americana*, "Radice tuberosa," and, as will be shown later, even if his expression "radice" may not be correct, he was evidently a careful observer, and is probably the first author who mentioned the circumstance.

On further examining the literature, of which unfortunately only a small part is accessible to me, I found that a few years after Michaux, Fr. Pursh † had described the plant as being "Herba glabra, tuberosa." It was supposed that the plant would be very exactly described by

* Tuberiferous *Hydrocotyle Americana* L. (Bulletin of the Torrey Botanical Club, Vol. XIII, No. 2, 1886.)

† Flora Americæ septentr., Vol. I, 1816, p. 190.

Achille Richard in his Monographie du genre Hydrocotyle;* but he says only: "Elle (*H. Americana*) a, selon Michaux, une racine tubéreuse."

Of all the species mentioned in De Candolle's Prodromus† only *Hydrocotyle interrupta* Muhl. was described as being tuberous, namely its variety tuberosa: "Caule hinc inde ad nodos tumido et tuberoso," which tuberosity then is quite different from that of *H. Americana*, and nothing has been written about the tubers of our plant. Eaton‡ is another American author who has mentioned it as "tuberous," but from his observation in 1833 until 1886 the plant does not seem to have been observed as being "tuberosa" nor "tuberiferous."

The stolons, Vasey's "tuberiferous threads," seem to have been known before, for Torrey§ has described the plant in this manner: "Stems with long suckers." It has also been mentioned by Darlington‖ as having "Filiform runners from the axils of the leaves," and further by Chapman,¶ who has called the stem "stoloniferous;" but these remarks are all that we know about them, and it is not perfectly sure that these authors have intended to describe the true stolons, since they may have seen only the runners of the plant.

On turning to the specimens of *Hydrocotyle Americana*, it is first to be remarked that the plants, which I have had the opportunity of examining from the Eastern Branch, and others from different places preserved in the herbaria of the U. S. National Museum and of the Department of Agriculture, all the complete individuals show that they have been developed from tubers. The development from the seed is not known, but it is to be supposed that there is little difference between this and the other method, excepting that it would be interesting to know whether the primary root has a tendency to be tuberous. There is no doubt that the plant is able to propagate itself by seeds, for many of the specimens I have seen bore fruits which were all normally developed. Plate XLVI, Fig. 1, illustrates the lower part of the stem of *Hydrocotyle Americana*, and shows the tuber from which the plant has been developed. We see that the rhizome consists of the tuber and a single internode, bearing a scale-like leaf, from the axil of which a long stolon has been developed; we see further that another branched stolon has been developed from the axil of the lowest complete but now faded leaf of the stem. From the axils of the other leaves at the upper part of the stem we see (Plate XLVI, Fig. 2) that two runners have been developed, and at the summit of the stem we find the inflorescence, which is not figured, since it is already well known.

It will be observed that our plant has two kinds of vegetative propagation: by stolons, ending with tubers, and by runners. Now, it

*Ann. sc. phys., IV, Tab. 55, Fig. 10, 1820.

†A. P. De Candolle: Prodromus syst. nat. regni vegetab., IV, 1830.

‡A. Eaton: Manual of Botany for North America, 1833, p. 180.

§John Torrey: Natural History of New York, Part I, 1843, p. 262.

‖William Darlington: Flora Cestrica, 1853, p. 99.

¶A. W. Chapman: Flora of the Southern United States, 1883, p. 158.

must be remarked that the stolons are always to be found under ground, but usually near its surface, and the runners are creeping on the earth. But it is probably a mere matter of accident as to whether these organs of propagation are developed as stolons or as runners. It seems to depend on certain circumstances, as the condition of the station, the softness or moistness of the ground, etc., and I think it very probable that the stolons might be transformed, or rather developed, as runners by being kept out of the ground and prevented from bending downwards under the surface of the earth. In every case, as it will be shown later, their structure is almost the same as that of the runners.

The stolons consist of several internodes, the length of which varies from less than 1 centimeter to 5 or 6 centimeters; they are white, translucent, and bear at each node a very small, scale-like sheathing leaf, cleft a little above its middle, as is shown in Plate XLVI, Figs. 3–4, where such a leaf is drawn from two sides, and under these leaves can be seen some very small and thin roots, which are often but slightly branched.

At the end of each stolon we see (Plate XLVI, Fig. 8) a tuber, of which the first internode is almost cylindrical, elongated, and usually about one-half centimeter in length, and longer than the other internodes of the tuber. The figures 8–11 on Plates XLVI and XLVII show four tubers of different sizes and states of development. The largest one (Fig. 10) had a length of 1½ centimeters, but this size is exceptional, as they are usually not longer than 1 centimeter. The number of internodes varies from two to six, but four is the most common. These internodes are cylindrical, often a little broader at the middle, and are yellowish-white in color. They are all provided with leaves, closely appressed to the nodes, and these leaves are scale-like, but always cleft to the middle, with the lobes ovate and nearly obtuse (Plate XLVII, Fig. 12). Usually three to five roots are to be seen under these leaves, which are in the young tubers developed, but as small warts, but later, by the germination of the tuber, they grow out and attain a development as small, thread-like roots, with only a few ramifications.

At the end of the tuber we see a conical bud, often somewhat pointed, and usually directed a little upwards, and this bud is able to develop an independent plant in the following spring, while the stolon is not persistent, but dies a short time after the formation of the tuber, during the fall or in the beginning of the winter. But, besides this bud at the end of the tuber, we find one in the axil of each tuber-scale, which is only developed as a small protuberance, which may develop into short-stalked tubers, or, more correctly, short stolons with tubers at their end, as it is shown on Plate XLVI, Fig. 7. It does not happen very often, according to the plants I have had the opportunity of examining, that these buds become so developed, but I should suppose that they are nevertheless of some importance for the propagation of the plant, if the tuber should be injured and the terminal bud destroyed. The impor-

tance of these stolons with their tubers must be very considerable for the propagation of the plant; but besides these tubers, with all their buds, we can find also in the axils of the leaves of the stolons small buds, which are not only able to develop lateral branches, ending in tubers, but also in some cases, as shown (Plate XLVI, Fig. 6), a short branch with leaves of the same shape as those belonging to the stem. The development of buds in this manner does not seem to be common, but I have found it in some of the specimens collected along the Eastern Branch. How far such a small branch may be developed I do not know, but some of them showed, besides the leaves, also some very young flowers, not perfectly developed, of which especially the calix and the corolla were rudimentary or almost wanting, not unlike what are called "clandestine flowers," but it is hardly probable that they are to be so considered. There is, then, in the stolons a certain ability of taking on the function of the runners also, by developing leaves and flowers, though these are not completely developed in the present case; but on the other hand it must be remembered that they were found under ground, therefore it seems that, had the conditions been better, they might have attained a more perfect development.

The other method of vegetative propagation in *Hydrocotyle Americana* is by runners. These are developed from the axils of the leaves of the upper part of the stem, as shown Plate XLVI, Fig. 2, and they attain frequently a length of 16 centimeters. They are translucent and have long internodes like the stolons, but are a little thicker than these, and bear leaves of the same shape as those of the stem, only proportionally shorter stalked. No buds were developed in the axils of these leaves, or at least not in the state in which I had opportunity of examining them.

Roots are developed under the leaves, but they seemed to be very weak, and this circumstance, in connection with the somewhat feeble development of the runners, does not make it probable that very extensive propagation takes place in that manner. The function of the runners is to form new plants when they are provided with roots at their nodes, and thereby creeping on the earth. But I have not been able to find a single young plant originating in this manner, and it does not seem probable that the runners could resist the frost of winter. Possibly their character as runners depends on the circumstance that they have not been able to bend themselves downwards before their long internodes were developed, and that they might not have been strong enough for penetrating the ground with their ends; for, as we have seen, they are only to be observed in the axils of the upper leaves of the stem. This last circumstance seems certainly to speak in favor of the supposition, owing to their character as merely runners: for the stem of our plant is a little ascending, so that only the branches from the lower-situated leaves can reach the ground pretty soon, while it must be necessary for those from the axils of the upper leaves, the

higher situated, to stretch themselves for reaching the ground, and I believe that the most natural and for the plant the most useful development of these branches from the axils of the leaves should be if they all were developed as tuberiferous stolons.

In regard to the internal structure of these organs, we see in the stolons a very distinct cuticula, showing several frownings, an epidermis of which the exterior walls of the cells are somewhat thick, while the interior ones are thinner, and show a development almost as collenchyma (Plate XLVII, Fig. 15). Stomata are present, but merely in a small number. Inside the epidermis there is a bark composed of parenchyma, with large cylindrical cells with very thin walls. There are usually six vascular bundles, with a distinct duct, apparently merely containing air, outside the phloëme, and there is no indication of any mechanical tissue either forming a sheath or isolated groups. The cells of the pith have the same shape and size as those of the bark. Starch is present in the bark, but is only to be observed in the younger state of the stolons; not at all by the older ones.

The structure of the runners is almost the same as that of the stolons, except that the stomata are more frequent; the cuticula does not show frownings, and the cells of epidermis have thinner walls. The bark and pith show the same structure, and the vascular bundles are stronger developed and the groups of phloëme and xyleme larger. The ducts outside the phloëme are also present in the runners.

The stem shows the same general structure, but the cells of the epidermis have attained a still greater thickness, and we find inside these a stratum of cells of an almost collenchymatous character (Plate XLVII, Fig. 14). Otherwise the structure is the same as that of the runners.

The complete want of mechanical tissue in the stolons and runners seems to indicate that their persistence can not be very long, and their anatomical structure shows a very uniform development in both.

As to the structure of the tubers, we find that a transverse cut of a young tuber, formed this year, shows a large amount of starch, deposited in the bark and pith, and in such a manner that its presence perfectly conceals the structure of the different strata of cells. But we may see, however, very distinctly usually six concentric rather large ducts, and these are of the same kind as those mentioned above. A transverse cut of an old tuber (Plate XLVII, Fig. 16), which has developed a plant, and therefore has been deprived of its starch, shows the structure much better. The cells of the epidermis do not show any essential difference from those of the runners, the structure of the bark and pith corresponds perfectly to the description given before, and the development of the vascular bundles is very uniform. The ducts are to be seen outside the phloëme, as in the stem, the runners, and the stolons; but outside these we find an endodermis, forming a ring around the vascular bundles, and whose cells show very thin walls, but somewhat indis-

tinctly the spots called after *Caspary*. No indication of mechanical tissue was to be observed in the tuber.

If we now turn to the description of our plant as given by the early authors and compare it with what has been shown here, we shall find that Michaux's "radice tuberosa" is to be regarded as an old tuber that has developed a plant, and Pursh's "herba glabra tuberosa" shows the same, and evidently he had seen more than a single tuber, since he has described not only the "radix" but the plant as being "tuberosa," and we suppose the same of Eaton's "tuberous." But as to the description of the stolons and runners, it is not sure whether what Torrey describes as "suckers" should be regarded as stolons or not, when a sucker, according to Gray's "Structural Botany," 1880, is "rising from a subterranean creeping base," and, as it has been shown above, our plant has no "suckers." "Darlington's filiform runners, from the axils of the leaves," may be nothing but the true runners; but, on the other hand, he does not mention if he has observed them in the axils of the upper leaves or where, and it might not be improbable that he had seen the base of the stolons also, but with the tubers broken off. Chapman's "stoloniferous" seems certainly to show that he has observed the presence of the true stolons, and it is a question why he did not mention the runners.

U. S. NATIONAL MUSEUM, *Washington*, *December*, 1888.

EXPLANATION OF PLATES.

Hydrocotyle Americana L.

PLATE XLVI.

FIG. 1. The lower part of the plant, developed from a tuber, with stolons ending in tubers.

2. The upper part of the plant, with two runners.

3, 4. A scale-like leaf from a stolon, seen from the front and back. R., roots.

5. A scale-like leaf from a stolon, supporting a branch with its first leaf L. R., roots.

6. A scale-like leaf from a stolon, supporting a branch with a leaf of the same shape as those of the stem. R., roots.

7. An old tuber, having developed a plant. Two stolons, ending in tubers, are to be seen, of which the one has been developed from the axil of the uppermost scale-like leaf of the old tuber.

8. A young tuber of the most common shape.

9. A young tuber just formed.

PLATE XLVII.

10. A young, very long tuber, consisting of six internodes.

11. A young tuber with a smaller one, developed from the axil of one of the lower-situated scale-like leaves.

12. Leaf of a tuber.

13. The development of a stolon, at the summit of which the bicleft leaf is to be seen.

FIG. 14. Transversal cut of a stem. Ep., epidermis. B., bark. D., the duct outside the phloëme. P., pith.

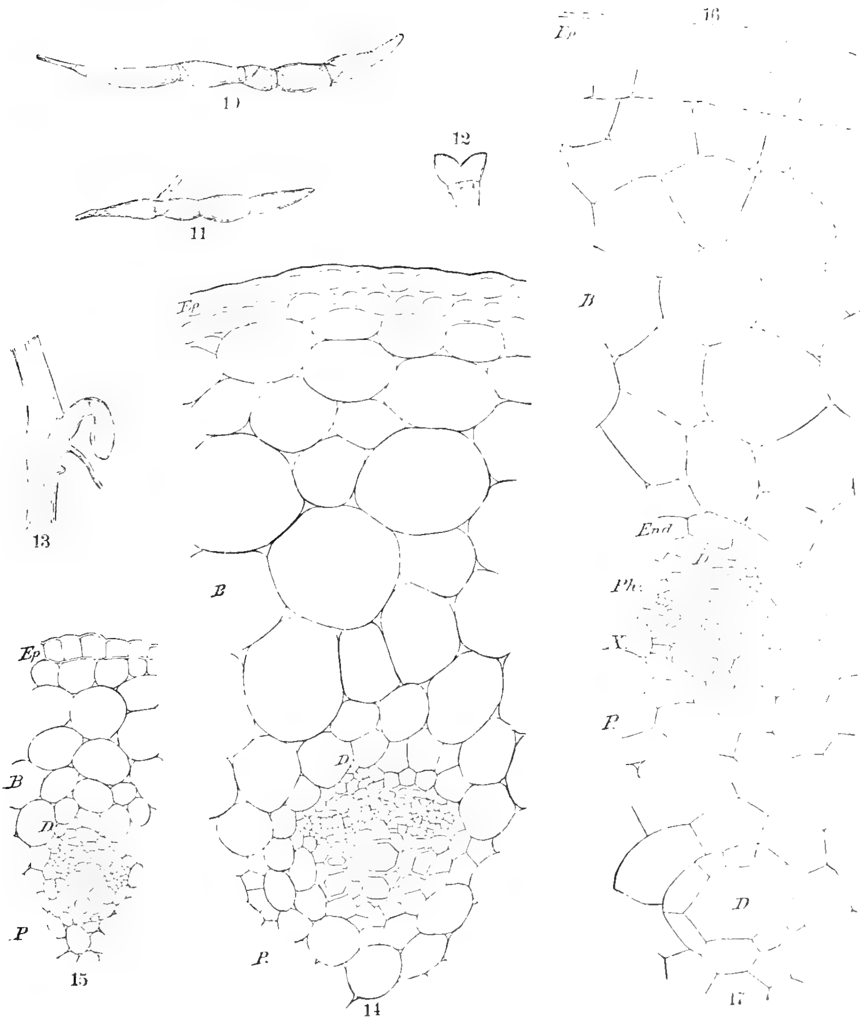
15. Transversal cut of a stolon. Ep., epidermis. B., bark. D., the duct. P., the pith.

16. Transversal cut of an old tuber. Ep., epidermis. B., bark. End., endodermis. D., the duct. Ph., phloëme. X., xylem. P., pith.

17. A duct, D., of an old tuber.

MORPHOLOGY OF HYDROCOTYLE AMERICANA *Linn.*

(Explanation of plate on page 161.)



MORPHOLOGY AND ANATOMY OF HYDROCOTYLE AMERICANA *Linn.*

(Explanation of plate on pages 461-462.)

NOTES ON SOME CALIFORNIA FISHES, WITH DESCRIPTIONS OF TWO NEW SPECIES.

BY CARL H. EIGENMANN AND ROSA S. EIGENMANN.

Gobius townsendi sp. nov.

Types, No. 40127, U. S. Nat. Mus. San Diego Bay.

Length of largest specimen .045^{m}.

Robust, compressed backward. Head heavy, blunt. Profile from eye to dorsal fin straight, in front of eye rounded.

Eye 1 in the snout, 4 in length of head, about equal to the interorbital region.

Mouth very slightly oblique, the premaxillary about on a level with the lower margin of the eye. Teeth in a band in each jaw, none of them enlarged.

Scales strongly ctenoid, largest on caudal peduncle. Breast and predorsal area naked.

Distance of dorsal fin from tip of snout $2\frac{1}{2}$–$2\frac{2}{3}$ in the length. Dorsal spines not filamentous, about half as high as the body. Space between the dorsal fins about equal to half the length of the first; soft rays higher than the spines, about $\frac{2}{3}$ height of body.

Caudal truncate, about 4 in the length. Ventrals not reaching the vent, 5 in the length. Pectorals little shorter than the head.

Sides with about eight dark cross-bars which are usually interrupted on the median line of the sides, a squarish dark spot thus meeting a light area of similar form and size, the dark predominating on the tail; a triangular spot at base of caudal, a rather large light area in front of it; top of head and lower lip evenly punctate with dark. A black spot before the spinous dorsal which is usually |-shaped, a larger one between the dorsals and others along the back to the caudal; belly and lower portion of sides white. Ventral and pectoral fins plain; anal sparingly dotted; caudal and soft dorsal more profusely dotted, the soft dorsal and anal sometimes black posteriorly; a large black spot on posterior part of the spinous dorsal; a cluster of dots before the pectoral.

Many specimens of this species were obtained with a skimming net in tide pools and ditches on mud flats. Like the species of Gillichthys it has the habit of hiding in crab holes when disturbed.

Specimens of *Gobius townsendi*, about .01^{m} in length, have the following color marks: A finely feathery pigment cell at tip of snout, one between the pupils, another at the occiput and a few smaller ones before it; a large cell on the back above the pectorals; a series of three large

cells somewhat removed from the one above the pectorals; and another series of six cells on the back somewhat removed from the series of three; a dark line extending from top of snout to origin of anal and continued as a series of large dark pigment spots to near the caudal. A few spots on the auditory capsule; a series of spots along upper portion of the air-bladder to near the caudal; a transparent bar near base of caudal. Tip of lower jaw black; sides tinged with yellow.

In the specimens of this species of about .01^{m} there arise on the head and sides hyaline threads corresponding to the mucus pores. These threads have no resemblance to hairs or bristles with which these structures have sometimes been compared. They are most numerous on the tail. There are 33 in the lateral line.

We have dedicated this species to Mr. C. H. Townsend, naturalist of the U. S. steamer *Albatross*.

Lepidogobius gilberti sp. nov.

Types, No. 40128, U. S. Nat. Mus. San Diego Bay.

Length of largest specimen .055^{m}.

Head 3–3$\frac{1}{3}$ (3$\frac{2}{3}$–4 in total); depth 5–5$\frac{1}{2}$ (6–7); D. V. 15 to 17; A. 14 to 16; Br. 5. Vert. 15+19.

Form elongate, compressed. Head long, subconical, about as high as wide; its width 2$\frac{1}{4}$ in its length. Profile nearly straight from eyes to spinous dorsal, decidedly decurved in front of eyes. Eye entirely above the premaxillary level, 1 in snout, 4$\frac{1}{2}$ in head, one-half in interorbital.

Mouth slightly oblique; maxillary extending to below middle of eye, the lower jaw slightly included. Teeth villiform, in a broad band in each jaw, the outer series of the lower jaw somewhat enlarged.

One, rarely two, dermal flaps on inner edge of shoulder girdle.

Scales cycloid, imbedded, very small; head, nape, and breast naked.

Distance from tip of snout to insertion of spinous dorsal 2$\frac{2}{5}$ in the length. Highest dorsal spine about two-fifths the length of the head; soft dorsal rays lower. Interdorsal area about half the orbital diameter. Tip of last dorsal ray not reaching base of caudal.

Caudal broad, and rounded when expanded.

Anal similar to the soft dorsal fin. Ventral fins large, nearly reaching the vent in specimens .045^{m} long. Pectorals usually shorter than the ventrals. Color in life, sand color; head and body with small rust-colored spots which are dotted with black, the punctulations forming a more or less regular net-work. Dorsal fins hyaline at base, bright rust-colored above and rather broadly margined with white, everywhere black punctate except on the margins; about three groups of black dots on each ray, giving a barred appearance to these fins. Caudal margined with white, upper and lower parts of the fin rust colored, median portion dark gray; about 5 wavy, rust-like, vertical bars; entire fin dotted with black except its margin. Anal fin hyaline at base, sparsely

dotted; its middle third jet black, margined with white. Pectorals and ventrals hyaline, colorless or yellowish, sparingly black dotted and white edged. A large, conspicuous, metallic blue-black spot on the opercle; top of head blackish; belly white or yellowish; chin and throat white, sometimes punctate.

Young lighter, showing the reticulations, but the other markings faint or undeveloped.

The types of this species were obtained by a Chinaman when digging for "crawfish" in the mud flats between Roseville and La Playa.

This species differs greatly from the known species of *Lepidogobius*. It is most nearly related to *L. newberrii*, belonging to the subgenus Eucyclogobius. Among other differences are the number of fin rays and the rounded caudal fin.

Some specimens, which may be the young of *Gillichthys mirabilis*, were associated with this species. The eyes are smaller than in *L. gilberti*, the mouth larger, the maxillary extending considerably beyond the orbit. The abdominal area is slightly longer, the ventral fins much shorter. The number of fin rays agree with those of *gilberti*. In specimens .045^{m} long there is a median series of black spots on the sides, and a series of less distinct blotches along the middle dorsal line. The cranial markings are as in the adult of *Gillichthys mirabilis*.

We have dedicated this species to Mr. C. H. Gilbert, Associate Professor of Zoology, Indiana University.

Ophiodon elongatus Girard.

This species, known from Monterey and northward, has frequently been caught off San Diego this winter.

Cebedichthys violaceus Girard.

This blenny has been recorded from San Francisco to Point Concepcion. In May, 1886, Mr. C. R. Orcutt collected a single specimen at San Quentin, Lower California, 200 miles south of San Diego.

Sebastichthys chlorostictus Jordan and Gilbert.

A large number of this species were caught off San Diego February 26. Like the preceding species, it has not before been recorded south of Monterey.

Sebastichthys vexillaris Jordan and Gilbert.

The species of Sebastichthys evidently do not bring forth their young at any particular time. Only one of the many specimens of *S. vexillaris* examined has been found with young. The ovary is double, as in *Sebastes marinus*, but contains a much greater number of young. The internal structure of the ovary agrees with the description of the ovary

Sept. 3, 1889.

of *Sebastes marinus* given by Prof. J. A. Ryder in the Bulletin of the U. S. Fish Commission, 1886, but Professor Ryder has evidently mistaken the character of the digitations described by him. An examination of the fresh gravid ovary proves beyond a doubt that the vascular digitations described by him are merely the ruptured follicles from which the eggs have escaped. The fact, however, that the follicle persists and remains highly vascular seems to indicate that it may, as Ryder has suggested, serve to aerate the blood of the fœtus.

San Diego, Cal., *March* 4, 1889.

ON THE OCCURRENCE OF ECHINOMYS SEMISPINOSUS, TOMES, IN NICARAGUA.

BY FREDERICK W. TRUE.

There is, so far as I am aware, no authentic record of the occurrence of any member of the family *Octodontidæ* in Central America. Alston, in his table of neotropical genera in Messrs. Godman and Salvin's Biologia Centrali-Americana,* included *Myopotamus* as an inhabitant of Central America, but on a subsequent page withdrew it with the remark: "I very much regret that I have been led into a misstatement." It affords me some degree of pleasure, therefore, to be able to record the occurrence of *Echinomys semispinosus* in Nicaragua. In a collection of mammals recently collected by Dr. Birt in the vicinity of Greytown, and presented to the Museum by the Nicaragua Canal Company, are five specimens belonging to the above-mentioned species.

Tomes' description applies exactly to these specimens, and there can, I think, be no question of their specific identity with the types. Measurements of three alcoholic specimens and of the skulls are given below.

Besides these Nicaraguan specimens of the species, the National Museum possesses three dry skins, Nos. 12900–12902, which were collected by Mr. J. C. Zélèdon in Pacuare, Costa Rica, in 1876.

These are smaller than the Nicaraguan individuals, considerably lighter in color, and somewhat less thickly covered with spines, but otherwise identical. It seems probable that they are young individuals of *Echinomys semispinosus.*

In addition to the Echinomys, Dr. Birt's collection includes specimens of the following species:

Mycetes palliatus, *Dicotyles labiatus* (jr.), *Sciurus hypopyrrhus* (melanistic), *Bradypus castaneiceps*, *Cycloturus didactylus*, *Tatusia novemcincta*, and *Didelphys opossum.*

Measurements of three alcoholic specimens of Echinomys semispinosus Tomes.

	16354/23252 ♂	16355/23253 ♂	16410/23230 ♂ jr.
	mm.	*mm.*	*mm.*
Length of head and body	236	258	169
Length of head	76	76	55
Length of tail-vertebræ	164	169	129
Length of fore foot (with claw)	32	32	28
Length of hind foot (with claw)	55	57.5	47.5
Extremity of snout to ear	70	63	39
Extremity of snout to eye	....	47.5	21
Height of ear from occiput	19	19	17
Height of ear from base of outer margin	25.5	27	24
Width of ear	19	19	16

* P. XVIII and p. 168.

Measurements of the skulls of the same specimens.

	23252/16354 ♂	23253/16355 ♂	23230/16410 ♂ jr.
	mm.	*mm.*	*mm.*
Basicranial length (Hensel)	45	....	33. 2
Greatest breadth across zygomatic arches	29. 5	....	24. 0
Length of nasals	23. 5	27. 0	17. 0
Breadth of nasals at anterior end	6. 5	6. 5	....
Breadth of nasals at posterior end (opposite fronto-maxillary suture)	4. 0	5. 0	3. 5
Least breadth between orbits	14. 0	....	12. 7
Diameter of orbit from frontal to malar	12. 0	....	10. 0
Length of upper molar series (crowns)	9. 5	9. 5	*6. 9
Anterior margin of first molar to posterior margin of incisor	14. 0	15. 2	10. 5
Posterior end of palate to posterior margin of incisor	22. 5	24. 0	17. 1
Length of lower molar series (crowns)	10. 0	10. 5	*7. 7
Height of coronoid process	2. 0	3. 2	1. 7
Depth of jaw below condyle	13. 7	15. 5	10. 5

* Only three molars are in position.

ON THE MAMMALS COLLECTED IN EASTERN HONDURAS IN 1887 BY MR. CHARLES H. TOWNSEND, WITH A DESCRIPTION OF A NEW SUBSPECIES OF CAPROMYS FROM LITTLE SWAN ISLAND.

BY FREDERICK W. TRUE.

1. *Description of Capromys brachyurus thoracatus*, subsp. nov.

Before considering the mammals collected by Mr. Townsend in Honduras, I will proceed to describe an apparently new subspecies of *Capromys*, of which this explorer obtained two specimens while journeying thither. These were caught on Little Swan Island, one of two small islands lying at the entrance of the Gulf of Honduras. The genus *Capromys* has hitherto been considered as peculiar to Cuba and Jamaica, and it is of much interest to learn that its range extends to the Swan Islands, which are distant only about 110 miles from the nearest point in Honduras, but fully 365 miles from the western end of Jamaica.

It is also noteworthy that the new form is specifically identical with the *Capromys* of the latter island, *C. brachyurus* Hill.* If the original description of that species is correct, however, the Swan Island form would appear to present certain differences in coloration which would entitle it to be ranked as a separate geographical race or subspecies. As the description of *C. brachyurus* is brief and is, furthermore, contained in a work not generally accessible, I will quote it in full, pointing out at the same time, in a parallel column, the differences of color presented by the two specimens obtained by Mr. Townsend.

Comparison of Capromys brachyurus Hill, and C. brachyurus thoracatus subsp. nov.

Capromys brachyurus Hill (original description).	*Capromys b. thoracatus*, subsp. nov.
Tail very short, about one-eighth of the total length.	The same.
Fur dense and harsh, generally from three-fourths to 1 inch in length, with a few longer hairs intermixed, but all of one kind.	The same.
Each hair is black, with a ring of bright bay or golden brown near the tip, imparting a brindled appearance to the fur, like that of a dark specimen of the Brown Rat.	Hairs dull, plumbeous brown at the base, with a subterminal ring of dull Naples yellow; tips blackish-brown. A few hairs entirely white, and others entirely dark, intermixed.
On the throat, breast, and belly, the fur is yellowish, becoming white along the mesial line.	Fur of the throat pale gray, with yellowish tips. *A band of nearly pure white hairs on the breast, between the fore legs;* followed on the belly by hair which is tinged with pale yellowish gray, darkest along the median line.

*Gosse, Naturalist in Jamaica, 1857, p. 471.

The feet are clothed with blackish hairs, short and stiff; the soles are black, roughened with rasp-like warts.	Feet clothed with short ringed hairs, like those of the back, but darker. Hairs of the proximal and inner portion of the hind feet ochreous yellow. Toes, blackish brown.
The thumb of the fore paws is a rudimentary tubercle, but armed with a distinct blunt nail.	The same.
The great toe of the hind foot set far back, separable, and thumb-like.	The same; not thumb-like.
Ears blackish gray; short and fleshy.	
Muffle (or broad flat termination of snout) blackish, clothed with a glistening pile of very short down, the extreme margins of the nostrils alone being naked. Mustaches long.	Muffle dark brown.
Incisors white; molars with two deep oblique folds externally and one internally.	
Tail stiff, taper, with rounded point; scaly, with thick, short, bristly hair, which is black on the upper surface, grayish-brown below; the base of the tail is nearly naked.	The same; hairs dark brown, very few on the lower surface.

The distinguishing features in the coloration of the *Capromys b. thoracatus*, as appears from this comparison, are the white band across the breast, the gray throat, and the brown and ochreous (not blackish) hind feet. In size and proportions these specimens agree very closely with the typical form.

Measurements of C. b. thoracatus, No. 15898, U. S. National Museum, Little Swan Island, Male.

	mm.		mm.
Length of head and body	344.	Height of ear from occiput	18.
Length of hind foot	65.	Height of ear from base of outer margin	25.
Length of fore foot	40.	Greatest breadth of ear	19.5
Length of tail	45.		

Measurements of two skulls of Capromys brachyurus thoracatus.

Measurement.	22691 ♂	22692*
	mm.	mm.
Greatest length of skull	68.5	....
Basicranial length (Hensel)	53.5	....
Greatest breadth of skull from malar to malar	35.5	....
Least breadth between orbits	17.7	18.0
Length of nasals	23.0	23.5
Length of frontals	23.0	23.0
Length of upper molar series	15.5	15.0
Distance between inner margins of anterior upper molars	2.0	2.1
Distance between inner margins of posterior upper molars	5.3	5.3
Distance from anterior upper molars to incisors	16.5	17.0
Length of lower molar series	15.5	15.5

* Skull broken.

2. *A list of the Mammals collected in Eastern Honduras.*

1. Mycetes palliatus Gray.

Two adult males, an adult female, and a young female of this species were obtained.* This species has not, I believe, hitherto been obtained north of Lake Nicaragua, and its discovery in Eastern Honduras considerably extends its known range.

2. Cebus hypoleucus Humboldt.

Two males and two females of this species were obtained. It has not been found, hitherto, I believe, north of Nicaragua. The specimens present the normal coloration.

3. Felis pardalis Linné.

Two specimens were obtained.

4. Nasua nasica Linné.

Two young specimens, about 260^{mm}. long, labeled Segovia River and Eastern Honduras respectively. The former, No. 15942, which is slightly the larger, is dark brown above, with a median band of blackish brown, and an area on each shoulder lighter brown than that of the sides. The annulations of the tail are distinct. The smaller skin, No. 16088, is darker on the sides, but the subterminal light brown rings of the hairs are more conspicuous, and the color does not change on the shoulders. The annulations of the tail are less distinct.

5. Cariacus clavatus True.

A series of six skins of this interesting simple-horned deer, of which I have recently published a description in an earlier part of this journal,† is included in Mr. Townsend's collection.

There are two males of two or three years, two females, and a single young individual of either sex. For a description of these skins I refer the reader to my recently-published essay on the species.

6. Scuirus hypopyrrhus Wagler.

The collection includes four skins of this species, which vary in color in a very remarkable manner. The backs are, however, of the same color in all the specimens, being grizzled from the fact that the color of the subterminal light yellow rings of the hairs is mingled with the pure black of the tips. The tuft behind the ear is ferruginous in all the specimens. In other respects they differ as follows:

15946, ♀. Segovia River, June 25, 1887. Under surfaces mixed black and rusty brown; an irregular median white band. Throat rusty brown. Feet black. Subterminal black band of the hairs of the under side of the tail very broad.

---

* The exact locality in Eastern Honduras from which these specimens were obtained is not given in the label. Mr. Townsend's explorations were, however, confined to the Segovia River and the vicinity of Truxillo.

† Proc. U. S. Nat. Mus., xi, 1889, p. 417.

15948, ♂. Segovia River, July 10, 1887. Under parts bright rufous, with but little white in the median line. Subterminal black band of the hairs of the tail comparatively narrow. Fore feet black; hind feet grizzled, except the inner toe and a small area adjacent, which are black.

15947, ♀. Segovia River, July 10, 1887. Throat and middle of belly bright rufous; area between the fore and hind legs white. Feet black. Subterminal black ring of hairs of under surface of tail very broad.

15956, ♂. Truxillo, Sept. 25, 1887. All the under surfaces, including inside of legs, pure white. Feet grizzled.

7. **Sciurus tephrogaster** Gray.

One specimen from Truxillo.

8. **Coelogenys paca** Linné.

One female specimen, of the same color as others in the collection from Costa Rica.

9. **Dasyprocta punctata** Gray.

Two males from the Segovia River, and two females, of which the exact locality of capture is not stated.

10. **Rhynchonycteris naso** Max. zu Weid.

One specimen from Truxillo.

11. **Tatusia novemcincta** Linné.

This armadillo appears to be abundant in Eastern Honduras. Mr. Townsend obtained seven specimens, three of which (a female and two young individuals) were from the Segovia River.

12. **Didelphys opossum** Linné.

A male from the Segovia River.

13. **Didelphys murina** Linné.

One specimen from the Segovia River.

THE PREPARATION OF JAPANESE LACQUER AND THE MANUFACTURE OF WAKASA LACQUER WARE.*

BY ROMYN HITCHCOCK.

Japanese lacquer is the product of a tree, the *Rhus vernicifera* D. C., which grows throughout the main island of Japan. It attains a large size, the trunks sometimes measuring a meter in diameter. It is said the tree will live for forty years, but only comparatively young trees are valued for the production of lacquer. Having yielded for several years they are cut down, the lacquer extracted from the branches, and young trees take their places.

The principal section of the lacquer industry is between the parallels of 37° and 39°, beginning about one hundred miles north of Tokio. The best lacquer, however, comes from much farther south, from Yoshino, in Yamato.

The lacquer exudes from horizontal cuts in the bark, in the form of a rather viscid emulsion, and may be collected from April to the end of October. In the spring it is more watery than in the later months. However, the sap never flows so freely that it can be collected in vessels, as has been stated by writers. It exudes slowly and is collected by means of a pointed spoon-like instrument and transferred to a wooden receptacle or tube of bamboo. Several cuts (6–10) are made in each tree, the last as high as a man can reach. Having thus prepared a dozen or more trees in rapid succession, the collector begins to collect the juice from the cuts in regular order, beginning with the one first cut.

Having finished the collecting he takes other groups of trees, and after about four days returns to the first, where, after removing the accumulated yield, he cuts again into the same trees, and repeats the same role fifteen or twenty times. Thus the work may go on for eighty to a hundred days. The utmost yield of a single tree is about 40–50 c. c. of raw lacquer.

As the sap first exudes it is a grayish-white thick or viscous fluid, which quickly turns yellow, and afterwards black where it is in contact with the air.

The sap thus collected is *ki-urushi*, *urushi* being the general name for lacquer. An inferior kind is obtained from the branches when the trees are cut down. The branches are soaked in water for several months, then taken up and slightly warmed, when a small quantity of sap exudes. This is *seshime urushi*.

The lacquer is strained through cotton cloth to free it from bits of wood and dirt, first being thoroughly stirred to break up lumps and make a uniform mixture.

---

* Read before the Chemical Society of Washington, April 11, 1889.

The product thus purified is known as *seshime urushi*, but this name, which has already been used to designate the lacquer from the branches, has now a different meaning and is applied to the cheaper kinds of raw lacquer, such as are used for the first coats in lacquering. These lacquers have usually lost some of their water by stirring in shallow receptacles exposed to the sun. They have undergone no further preparation.

Many varieties of lacquer are prepared for special purposes, ranging in price from $1 or $2 to $6 or $7 per kilogram. These differ in quality and color. There is a famous black lacquer prepared by the addition of iron which forms a chemical combination to be mentioned further on; while red, green, yellow, and other colors are imparted by addition of various pigments, as cinnabar for red, orpiment and indigo together for green, orpiment for yellow, etc. Ultramarine is decomposed by lacquer, giving off sulphuretted hydrogen. Certain lacquers have a small proportion of a drying oil, *ye no abura*, perilla oil, added to them. The lacquer known as *shiu urushi*, the use of which will be referred to soon, contains from 1 to 10 per cent. of this oil. The name *shiu urushi* means cinnabar lacquer, and is applied to this variety because it is commonly used to mix with cinnabar when a red lacquer is required.

The chemical composition of lacquer has been well studied by Dr. J. J. Rein,* and later by Korschelt and Yoshida.† From the writings of these authors I have gathered most of the information here presented relative to the chemistry of the subject.

The emulsion as it comes from the tree consists of an aqueous fluid holding in suspension numerous very minute brown globules and a smaller proportion of lighter colored larger globules. The former are insoluble in water but soluble in alcohol. The latter dissolve in water.

The raw lacquer is almost completely soluble in alcohol, ether, carbon bisulphide, benzine, and solvents of gum-resins in general. The most important and abundant constituent is urushic acid, which occurs in the form of the minute spherules already mentioned. The acid is obtained by evaporating the alcoholic solution to a sirupy liquid. The evaporation must be carried on over a water-bath. If too much heat be applied a tough, black, rubber-like substance is obtained, which I found very troublesome to remove from the dish, and only strong nitric acid would affect it in the slightest degree.

As thus obtained, urushic acid yields on analysis numbers corresponding approximately with the formula $C_{14} H_{18} O_2$. This is the formula assigned to the acid by Korschelt and Yoshida. It is soluble in alcohol, chloroform, etc., but quite insoluble in water. It possesses marked acid properties, turns litmus paper red and forms salts with metals. With iron salts it forms a black compound, to which the color of the fine roiro

* Oesterreische Monatschrift für den Orient 1882, and Japan nach Reisen und Studien, vol. ii.

† Trans. Asiatic Soc. of Japan, xii (1884) 182–229. Also Forestry and Forest Products. Edinburgh, 1885.

lacquer is due. With plumbic acetate it yields a gray, flocculent precipitate.

Although the drying, or rather the hardening, properties of lacquer are doubtless due to the oxidation of urushic acid, the product extracted by alcohol, as described above, possesses no drying qualities. This fact was first observed by Professor Rein, in 1874. More recently Korschelt and Yoshida have investigated the process of lacquer hardening, and have found that a peculiar albuminoid of lacquer effects the drying by a diastatic or fermentive action. It is rather surprising that some one has not ascribed the result to a new species of bacterium, but this is doubtless due to the fact that the microscopists and bacteriologists have not yet got to work on lacquer. The fact seems to be that the lacquer hardens only when the albuminous substance is present. If heated above 60° C., or above the temperature at which albumen coagulates, the lacquer will not dry.

The authors mentioned regard the drying as a process of oxidation brought about in some way by the albuminoid, $C_{14} H_{18} O_2 + O = C_{14} H_{18} O_3$. Professor Rein, however, maintains that the process of hardening is not so simple, for the reason that moisture is essential to the drying of lacquer. The drying takes place only within a narrow range of temperature—between 20° and 27° is the most favorable; Korschelt and Yoshida have shown that no water is taken up by the acid in drying.

The strongest evidence of the importance of the albuminoid to the hardening process is found in the fact that while the urushic acid will not dry by itself, it immediately hardens if a portion of the unboiled gum and albumen that does not dissolve in alcohol be added to it, and the rapidity of hardening depends upon the proportion added. It is notable that the albuminoid does not lose its peculiar property of effecting this oxidation by treatment with alcohol. This nitrogenous constituent obtained from the aqueous solution has not been satisfactorily studied. It seems to contain less hydrogen than albumen.

Besides urushic acid and the albuminoid raw lacquer contains a gum resembling gum Arabic, which doubtless imparts some useful properties to the lacquer, and a volatile acid, to which Professor Rein ascribes the poisonous effects of lacquer.

The proportion of urushic acid varies from 85 to 60 per cent. in different samples; of gum, from 3 to 6 per cent.; nitrogenous substance, 2 to 3 per cent.; water, 9 to 33 per cent.

Oxyurushic acid, the product of the oxidation of urushic acid, as already explained, may be obtained by treating urushic acid with chromic acid. The mixture becomes first pasty, then solid, and of a brown color. The product was analyzed and gave the formula $C_{14} H_{18} O_3$. It is insouble in every solvent tried: caustic alkalies, hot or cold, boiling hydrochloric and sulphuric acids have no effect. Boiling nitric acid converts it into a yellow mass, which gradually dissolves.

The investigations of Korschelt and Yoshida included the study of

several salts of urushic acid and the preparation of several of its derivatives, as hexabromurushic acid and dinitrourushic acid, and some excellent suggestions for improving the quality of lacquered articles.

We now come to the further preparation of lacquer for use in the manufacture of the several varieties of lacquered articles, and I would say that whoever is sufficiently interested in the subject to spend an hour at the National Museum will find the process of manufacture very fully illustrated there.

A portion of the raw lacquer, about 16 pounds, is poured into a large circular wooden vessel, and vigorously stirred with a long-handled tool for five or six hours, while the heat of a small charcoal furnace is ingeniously thrown upon the surface to evaporate the water. During the stirring certain ingredients may be added from time to time. I have seen this operation as conducted in Osaka. The *roiro*, a fine black lacquer, is made by adding iron at this stage. In Tokio a soluble salt of iron is used, but the Osaka manufacturer objects to that, asserting that it injures the quality of the lacquer. The material used in Osaka was the fine iron dust collected from the grinding of knives. This was added in quantities of about a tea-cup full of powder mixed with water at a time, until the desired color was obtained. When the work is finished the lacquer is poured into a vessel to settle and is afterwards drawn off from the sediment. The various other additions made to the raw lacquer in the course of manufacture have already been mentioned.

The wood generally used for lacquer work is the light, easily-worked *hinoki*, a coniferous wood from the *Chamæcyparis* (*Retinospora*) *obtusa*. It is prepared to receive the lacquer in various ways. For inferior work it is first covered with paper, but in the finer qualities paper is not used. The operations to be described apply to the manufacture of that variety of lacquer known as Wakasa lacquer, and are from personal observation. The wood is first carefully smoothed and the corners of the boxes strengthened by gluing pieces of cotton or hemp cloth around them with raw lacquer. All joints and imperfections are then filled with *tsugi urushi* (*tsugi*, to fasten), which fills like putty. This is a dark-colored mixture composed of rice flour made into a paste with water and mixed with *seshime urushi*. It soon hardens so that it can scarcely be cut with a knife. Sometimes finely cut hemp is mixed with the *tsugi urushi*. The tool used for this work is the *take no hera*. The work is then covered with *jinoko*, a mixture of *seshime urushi* and a coarse powder of a yellowish color. The mixture is soft, of a yellowish-brown color, changing to black by exposure to the air. It is spread with a wooden instrument called *hera*. You will observe that the specimen box is only covered on the bottom and the outside with this mixture. This is because it is only deemed necessary to cover those parts most subject to wear. The article is left for a few days in the open air to allow some of the water to evaporate, after which it is placed in a moist-

air closet to harden. In this way a very hard, gritty surface is obtained, affording an excellent ground for the succeeding coat.

This process is not applied in making inferior goods. For these a mixture of the powder with glue is sometimes used, and for this reason cheap ware sometimes blisters when used with hot water, the glue swelling if the water reaches it. Similar blistering may also be occasioned by the natural gum of the lacquer if it should be present in excessive quantity.

The next process consists in covering the entire box with two coats of lacquer, containing a finer powder known as *tonoko*, which is a kind of ochre much used in Japan for cleaning and polishing. This is likewise evenly spread with the *hera*. Three coats of this are applied over the joints. The object of this process is to secure an even, smooth-grained surface for subsequent work. The surface is finally rubbed down with a kind of stone called *toishi*.

The parts that are not to receive any decoration are now ready for the finishing applications of lacquer. The other parts are next covered with a black lacquer, *naka muri urushi*, which you will see is in this instance applied to the outer surfaces and top edges of the sides. The lacquer used is *shitaji urushi* mixed with a kind of black lacquer known as *honkuro*, *hon* meaning not false, *kuro*, black. This is probably the best kind of roiro lacquer. It is applied with a brush, and requires to be rubbed down. The specimen has not been rubbed.

Two coats of black lacquer are now applied. The first is *roiro* put on with a broad brush. This dries with a brilliant reflecting surface. When quite hard the second application is made, and in this, while still soft, the designs are impressed. I use the word impressed because in the Wakasa lacquer there is no painting or drawing, but the figures are produced in a very curious manner. The white decoration is applied by dropping egg-shell powder in patches here and there. This is done very skillfully by the hand. The other designs are made by pressing various forms of leaves into the soft surface. Thus, the radiating or wheel-like pattern is produced by so arranging the needle-like leaves of the pine, the more complex leaf-pattern with the leaves of an evergreen (*Thuya orientalis*), while many other effects are made by scattering over the surface husks of rice, and these mingled with very short pine needles. The mother of pearl from shells is also used. You will understand this perfectly by inspection of the specimen which shows this stage of the work. The designs become more or less modified by the subsequent operations.

The lacquer retains the impressions thus produced, when, after the leaves, etc., have been imbedded about a day, everything except the egg-shell powder and mother of pearl is removed. The article is then put in the moist closet until it is thoroughly hardened, which may require ten days or a fortnight. The egg-shell is in little heaps, the leaf impressions are beneath the general surface. It is now necessary to fill

up all depressions and once more secure an even surface. The first step is to rub down the most conspicuous projections until there is much less irregularity of surface, but even after several successive coats of lacquer there will remain some elevations and depressions.

The next application is a transparent lacquer colored yellow with arsenic sulphide. This is put on with a *hake* and spread as evenly as possible. The object of this is to afford a yellow ground for the gold which is to follow.

A thin coat of *shiu-ai urushi* is spread over this and the whole completely covered with gold leaf. Then successive coats of the same lacquer, which is a transparent red lacquer, are applied until the surface is quite even. The surface then appears entirely black, beneath which all the gold and decorations are concealed.

Instead of a red ground, green is sometimes desired, as in *awo urushi* or green lacquer. To make this the *shiu urushi* is mixed with a green pigment. Two samples of the green variety of Wakasa lacquer are shown on the sample board. The green lacquer is known as *seishitsu.*

The next operation is to rub down the surface with stone *toishi* or *sai kido* until the design is again visible. The pattern is now revealed in gold with the pure white of the egg-shell powder to relieve the effect.

The work is finally rubbed with a special kind of charcoal, known as *hozumi*, which is made from the wood called *hinoki*. This gives a perfect surface, but to make it more brilliant it is covered with a finishing coat of fine lacquer *tsuya urushi.*

I have chosen the Wakasa variety of lacquer for description because I have had better opportunities to observe the different processes in this branch of lacquer work than in the others. Moreover, it has not been hitherto described in detail, so far as I am aware, and, indeed, it is a kind of lacquer far less common in the home as well as in the foreign market. Because of the good quality of the materials used and the quantity of gold required, it is more expensive than the common varieties and more durable. Descriptions of the methods of painting and decorating other kinds of lacquer ware may be found in various publications.

To make practical application of these remarks I would say that the peculiar qualities of lacquer make it seem worthy of more consideration than it has received in this country. It gives a surface to wood much harder than our best copal varnish, without brittleness. It takes a polish not to be excelled which lasts for centuries, as we may see in the old treasures of Japan. It is proof against boiling water, alcohol, and, indeed, it seems to be insoluble in every agent known. It is the best possible application for laboratory tables. I have a set of photographer's developing trays, one of which is before you, that has been in use for more than a year, and I find them excellent and cheap. In Japan it is used for many household articles, some of which are before you.

A very serious objection to the use of lacquer in this country is the danger of lacquer poisoning from the fresh material. I have recently heard of a piano-maker who tried to use it, but it affected his workmen so seriously that he was obliged to give it up. The Japanese are very much in dread of the poison, as I found when I tried to get some of my students to accompany me as interpreters to the places of manufacture. Those who are subject to the poison suffer precisely as patients afflicted by the *Rhus* or poison-ivy. Of course those engaged in lacquer work are not affected by it, but whether one acquires immunity after a time I am unable to tell. However, if the poison is a volatile acid, as Rein supposes, it would seem possible to remove it by a heat that would leave the lacquer uninjured, and thus make it available for use in this country.

A FOSSIL LINGULA PRESERVING THE CAST OF THE PEDUNCLE.*

BY CHARLES D. WALCOTT.

The known examples of the preservation of the cast of any of the fleshy parts of a brachiopod in a fossil state are very few. Two only have heretofore come under my notice. One is the peduncle of *Eichwaldia subtrigonalis*, figured by Davidson from a silicified specimen collected from the Black River limestone in Canada (Mong. Brit. Foss., Brach., Vol. III, p. 192), and the other the peduncle of *Lingula? lesueuri*, figured by the same author (Vol. IV, p. 362, pl. xl, fig. 16).

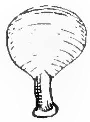


FIG. 1.

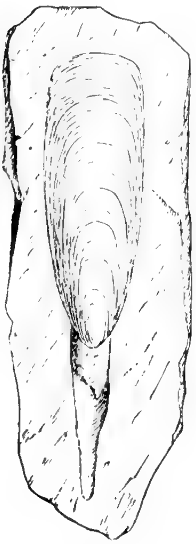


FIG. 2.

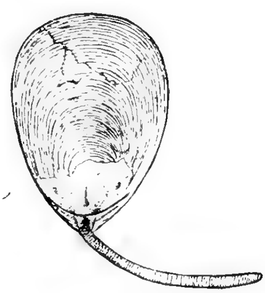


FIG. 3.

Figures 1 and 2 are copies of the original figures.

FIG. 1.—*Eichwaldia subtrigonalis*, showing peduncle issuing from the beak of the ventral valve (after Davidson).

FIG. 2.—*Lingula? lesueuri*, showing peduncle issuing from between the valves (after Davidson).

FIG. 3.—*Lingula æqualis* Hall, showing peduncle extending out from the ventral ? valve.

The specimen to which I now call your attention shows the interior of the anterior portion of the ventral valve of the *Lingula æqualis* Hall, collected near Rome, N. Y., from the upper portion of the Lorraine Terrain. The portions of the shell remaining in the matrix show the median ridge extending back from the divaricator muscular scar, the reflex portion of the shell forming the false area and the groove for the passage of the peduncle. The portion of the peduncle preserved is nearly as long as the entire length of the shell.

I am indebted to Mr. William P. Rust, of Trenton Falls, N. Y., for the use of the specimen illustrated. It will be deposited in the collection of the U. S. National Museum.

* Read before the Biological Society of Washington, December 3, 1887.

NOTES ON THE SPECIES OF LACHNOSTERNA OF TEMPERATE NORTH AMERICA, WITH DESCRIPTIONS OF NEW SPECIES.

BY JOHN B. SMITH.

(With Plates XLVIII—LX.)

Few genera containing large species, or insects of even average size, have been for so long a time in a chaotic state as the genus *Lachnosterna*. Abundant everywhere in early summer, the insects were largely looked upon as nuisances by collectors because, first, they looked very much alike, and second, because no one seemed to know exactly what names to put on them. The collector who pinned up large series, and obtained specimens from correspondents, soon came to the conclusion that not only were there numerous species, but there were numerous names for every species, and they gradually became resigned to a mass of material that might contain many or few species. There is a distressing similarity of color, form, and size throughout the genus, and yet quite sufficient individual variation in each of these points to make specific recognition in some groups all but impossible. Perhaps not more than two or three collections were correctly named a few years ago, and one of these was the type collection of Dr. Leconte.

In my early, enthusiastic days, when it seemed easy to straighten out all that was crooked in entomology, *Bembidium* and *Lachnosterna* among the Coleoptera attracted my especial attention, and I gathered in material from all sources, until I thought I had enough, and then on the occasion of a visit to Dr. Horn, announced my intention of working up these genera. Dr. Horn kindly showed me his material, and opened box after box to my astonished vision, quietly discussing the characters requiring study, and the literature that must be consulted. Needless to say that when I left Dr. Horn's collection I was thoroughly cured of my ambition, at least so far as *Bembidium* and *Lachnosterna* were concerned. Thereafter I contented myself with accumulating material.

Recently, in the Transactions of the American Entomological Society, XIV, pp. 209–296, Dr. Horn has redeemed a long-standing promise, and given us a revision of the species of *Lachnosterna*, which has rendered possible an intelligent collection and arrangement of the species. Upon this paper the following notes are based.

While working on the genus, Dr. Horn visited the Museum, and looked over such of the material as I could gather together at short notice, naming many species, and pointing out their salient characters. He also kindly offered to determine all of our material if sent him. Accordingly Professor Riley directed me to look out, arrange, and send series of all

Sept. 3, 1889.

our species to Dr. Horn. This I did, and the specimens were promptly returned. The most casual glance over the returned material showed that I had failed to discover the specific characters in my superficial arrangement of the series, and the material was left intact until the appearance of Dr. Horn's paper.

When this at last came to hand, it was an easy task with the book and named specimens to correctly determine all of the unnamed material. In order to familiarize myself with the characters used, I carefully compared each species with its description, and noted the variations observed. As I found that our material covered a wider territory than that seen by Dr. Horn, I added localities and, so far as our specimens showed them, dates of capture as well. Without any definite idea in making these notes, it occurred to me that they might be useful in a list of the species contained in the Museum collection.

Our material was remarkably rich in specimens and species. My own collection, purchased by the Museum, contained a full representation of forms found around New York City, and many lots obtained in bulk by exchange from all parts of the country.

The Riley collection donated to the Museum, was rich in material from Texas and the Mississippi Valley, and especially valuable because much of it was dated, or contained other information on the labels.

From the Morrison collection, purchased for the Museum, we had long series of several species, principally from North Carolina. Finally, in the Department of Agriculture and Museum collection proper, there were many specimens from all parts of the country sent in by correspondents or because of injuries caused by them.

The fauna of the District of Columbia was not very well represented, and to obtain full series of local species, and to gather information on food habits, dates of appearances, etc., Mr. Schwarz and myself determined to make a series of collections and observations—a work which first induced the idea of this paper from the results of our observations; results not at all anticipated when we started collecting.

The arrangement of the *fusca* group, or more correctly the union of forms under the specific term *fusca*, by Dr. Horn did not strike me as entitled to be called final; the less so, as Dr. Horn evidently was not quite satisfied himself, and we were in hopes of finding some more satisfactory limit for the species. In all these points we were successful, as the following will show.

I desire here to acknowledge my indebtedness to Mr. E. A. Schwarz for his aid in collecting specimens, for his pertinent suggestions, and for assistance in the work of ascertaining the range of the species. Messrs. Pergande and Alwood, of the Department of Agriculture, joined in many of the evening excursions and kindly placed at my disposal all the material obtained by them. Mr. C. H. Roberts, visiting Washington at that time, also joined me in the collections made near my own house, and together we found many species. Mr. Ulke, who, while the

others were haunting the woods, collected at the electric light and gave many specimens for the purposes of study, also deserves my thanks. Professor Riley, by his kind permission to use the Museum material, and the suggestions offered, has materially added to the completeness of the paper. Finally Dr. Horn has my sincere thanks for the liberality which induced him to place even unique types at my disposal for the study of the genitalia. I am happy to say that I did not in any way injure a single specimen. In addition to the material from the sources above enumerated, I have also received and studied numerous lots of specimens sent me by correspondents from all parts of the United States, so that I believe that I have seen and carefully examined more specimens of *Lachnosterna* than even Dr. Horn in his original study of the genus.

In the course of our collections I first noted in specimens taken *in coitu* a difference in the appearance of the male genitalia. I am aware that in a somewhat fragmentary way the genitalia of some genera of Coleoptera have been studied in Europe, and that a few of our *Scarabæidæ* also have been studied in connection with European species, but I have made no exhaustive study of the literature of this subject. In this country Dr. Horn has made use of the sexual structures in his study of the species of *Corphyra*, but, so far as I am aware, no other American author has made anything like a systematic attempt at their study.

The positive results seen by me in my studies of these organs in the Lepidoptera led me to a careful examination of them in the species here, in the hope that here might be the character by which the species of the *fusca* group could be finally and satisfactorily separated. The hope was realized even more fully than I had expected, and the great differences found in the males led to an examination of the females for correlated structures, which proved as distinctive as those of the male, and which, so far as I am aware, have not been hitherto studied.

A striking character in the males of many species is the remarkable asymmetry of the organs, for which I can not find an entirely satisfactory reason, and to which there seems to be no exact correlation of female structures. I shall, further on, give the only explanation that I have been able to find—whether sufficient or not I can not at present be sure. I shall not endeavor to make any generalizations from the characters described, fully realizing that it is much too soon for that. I simply wish to add some information regarding the characters of the species, and to record my ideas as to the standing of others. The characters afforded by the genitalia of both male and female will, I am convinced, be more and more used in the future to decide questions of specific identity. Perhaps it may be of interest to quote from Dr. Kraatz on this subject, Dr. Kraatz having worked considerably and well in this line. He says (Deutsche Ent. Zeitschr., 1881, v. 25, p. 116):

(1) Larger, natural groups, show a typical form of *penis*, but not always.

(2) The naturalness of certain genera can often be demonstrated by the peculiar formation of the *penis*, where there is a lack of other striking characters; it is a supplementary character of great value.

(3) Most species, and often very similar ones, show great, often remarkable, differences in the structure of the *penis*.

To these conclusions my studies induce me to give full consent, save that the first may be subject to some farther modifications or limitations. This paper by Kraatz gives a very fair and well-written review of the literature of the study of the genitalia, and is well deserving of careful reading by all interested in the study of these structures. I would emphasize in addition to the conclusions above cited that the characters are invariable within specific limits, and that while identity of genital structure is not always indicative of specific identity, difference of this structure is always indicative of specific difference.

Lacordaire is said to have called these structures the "key to species," and, while hardly willing to accept that dictum to its full extent, it certainly has proved so in *Lachnosterna*.

The rather remarkable result reached in the study of these organs in the forms allied to *fusca*, and confounded under the same name, may seem indicative of a tendency to a too minute subdivision of forms upon internal structures; but here I only emphasize by them the external characters which otherwise would warrant only Dr. Horn's conclusions that they are individual, evanescent, and scarcely varietal. The fact that in some localities two or more of the forms occur together will make it necessary to collect more carefully and in larger series, and also to devote more study to the separation of the species.

The correlation of the ♀ parts to the ♂ structures will make it necessary to devote more attention to this sex in the future, and there is no reason why, with a fresh specimen, determination from that sex should not be as absolute or as easy as that of the ♂.

A difficulty in description arises from the want of a nomenclature of the parts. Descriptive terms are lacking for the peculiar forms assumed by the clasper of the ♂, while for the ♀ I have been unable to find any nomenclature whatever.

For the males, J. S. Baly has proposed a nomenclature, in Trans. Ent. Soc. Lond., 1879, p. 173, but this is not entirely applicable to the present genus, and is, in my opinion, far from the best that can be proposed. He calls the entire male organ the "telum." I propose to use this term for the corneous tube inclosing the true membranous penis and the other soft parts. It differs in structure in *Lachnosterna* in that it varies from a complete tube to a half cylinder, closed or open at the top. I have made no use of the variations of this part, and doubt its ever furnishing available characters. Surmounting this are the claspers, or, as Baly says, the "apex." These are the organs whose variations furnish the specific characters, and I believe the term clasper, expressive of its use, is better than the term apex, expressive merely of position. What Baly calls the "valve" I have been unable to fix satis-

factorily in this genus, and therefore use neither the term nor any substitute. What I take to be the true penis or intromittent organ, Baly calls the "duct." It is entirely membranous and therefore useless in classification. The variations mentioned by Baly are largely individual, and will vary according as the specimen has or has not copulated.

In the females I have found no guide at all to a nomenclature. The structures, as they appear in *Lachnosterna*, consist of a pair of broad inferior plates, of a generally similar shape and which I do not specifically refer to in this paper, as the other structures render their use unnecessary. They may however in other groups prove of value. Above these are a pair of superior plates, generally smaller and narrower than the inferior, and much more variable. When the organs are most fully developed these plates are excised at their point of superior union, and are surmounted by a pubic process very variable in shape in the species, and this organ is the one which furnishes most of the characters used in this paper. Where this structure is not present the superior plates are much more specialized, and the variations are then specific. In a very few species the corneous characters are reduced to a single pair of imperfectly chitinized plates, and there are then no visible differences to be observed. I have found that the more unsymmetrical and the more developed the character of the male, the stronger will be found the characters of the female. As the male characters become symmetrical the female characters become less prominent, the pubic process first disappearing, until with the least development of the males the corneous characters disappear almost entirely and at all events are useless for specific identification.

I shall not undertake very full verbal descriptions of these parts, but prefer to let my figures answer most of the questions. A reference to these figures will show my reason very clearly, as no words could accurately describe the peculiar turnings and twistings. The mobility of the male claspers is not great in any case, and in some species they are absolutely immobile, being united in front and forming a complete ring. The modification in these species is not very great, and in the females the characters are, of course, correspondingly weak. It is not easy to watch coition in these insects, though specimens *in coitu* are not uncommon in some species. *Tristis* is most usually found *in coitu*, *hirticula* next, in my experience, and the others comparatively rare. *Tristis* is one of those in which the claspers are not mobile, and no observations could be made of their use. *Hirticula* has claspers which are decidedly dissimilar, while the female structures are well marked. I never succeeded in seeing the union of the sexes, though quite a number were taken united. From these specimens I tried to see the method of union, but was not very successful, as the male claspers so completely envelope the female parts that little could be seen of them. I did see, however, that the claspers held more particularly the pubic process, and that the inferior plates are not at all concerned in the

union of the sexes. I tried prying the claspers apart, but they broke rather than yielded; pulling resulted in tearing out the organs of one or the other; and then it struck me that possibly a little twist might loosen them, and it did. I found it easy thereafter to disconnect the corneous portions of the sexes by simply turning the specimens at right angles to each other; this unlocked them at once. The apparent immobility or very slight range of motion might possibly explain the asymmetry by the suggestion that the claspers form a real lock, which by a simple twist engages the corresponding female hasp or process, and holds it fast against all direct strains, yielding at once, however, to the unlocking motion. Consistent with this is the fact that all those species with dissimilar claspers have well-developed female organs, while greater simplicity in the ♂ is accompanied by a reduction and final loss of corneous parts in the ♀. Why this should be so I do not venture to explain.

Further comments and suggestions belong more properly under the notes on the species.

It is easy in fresh specimens to extrude the genitalia in both sexes. Simple pressure of the abdomen will usually force them out at once to full view. In alcoholic specimens a curved forceps inserted in the anal opening will readily grasp the corneous processes and bring them to view without difficulty. In dry specimens the abdomen can be readily removed, the organs taken out, and the abdomen then replaced with a drop of shellac. It is more easy, however, to relax by throwing in water for a couple of hours, when they can be treated as are alcoholic specimens. Much more rapid and in many respects more satisfactory is turning a small jet of steam on the specimen, which will render it fit for examination in about two minutes. I relaxed most of the specimens examined by turning the escape valve of the steam-heater in my room at the Museum into a large jar containing the specimens to be softened. This, by the bye, is our method of softening dried Coleoptera for mounting; unfortunately it is available only in the winter, when the steam-heaters are in use.

Before going on to the annotations I will give the results of the collections made during the season of 1888 by the combined forces of the Washington entomologists, not only to show the quantity of material at command, but also to give an idea of the richness of the fauna of the District and to show what thorough collecting in any one locality will bring to light.

Several points were visited. Our principal collecting ground was the park surrounding the Department of Agriculture. In one corner were many young oaks and hickorys of various species, and here, with a grassy lawn kept free from all undergrowth, was an ideal place. The outfit consisted of an umbrella, a heavy stick, a lantern, and unlimited bottles. One man handled the umbrella and cane; that is, he did the beating of the trees, while the other managed the lantern and bottles, both gath-

ering in the spoils. Usually there were two parties. The species begin to fly just at dusk, and a few could be taken before dark on low trees. As soon as darkness set in, the buzzing became audible everywhere, and hundreds of insects could be felt rather than seen, while the trees began rustling as with life. It was interesting to note the start of the specimens. First a slight whirr of wings in the grass, then a momentary silence followed by another whirr, this again followed by an interval before the specimen finally flew off with a hum. Beating began at dark, when a branch outlined by the faint light of the sky could be seen to be surrounded by the multitude of specimens. Work was steadily continued, the same trees being visited at short intervals until 9.30 to 10 p. m., when the beetles were generally settled for the night and ceased flying. By this time, too, our bottles were generally sufficiently full, and we were ready to quit. We found that young trees were the favorites throughout, and that the crowns and upper branches of large trees suffered most.

In order to try the effect of different surroundings, we made occasional excursions to the Virginia side of the Potomac, just above Washington, and here we took other species in smaller numbers and with infinitely more trouble.

My house is situated on Lanier Heights, about half a mile outside of the city, to the north, and on the crest of a hill overlooking Rock Creek Valley. The ground is bare, and there are no trees except along the road and on my grounds. On the terrace back of my house a few young pear trees proved a source of great attraction, and only persistent collection saved them from complete destruction. In front of my house I have about 50 feet of privet hedge, and into this, on some evenings, I could put my hands at random, sure to get a few specimens. They ate little of this, however, and did no appreciable damage. A Wistaria vine on one side of my front porch was still more attractive, and this they damaged badly. They did not touch my roses, though others reported great damage to them. At the foot of the hill upon which the house stands, and at the entrance of a deep, narrow valley leading to Rock Creek, there are a few large oaks, and here only *L. affinis* was found feeding.

Finally we made three trips to Rock Creek Valley, with poor success; for though there were plenty of the most attractive and convenient trees for the imagos, there is no true sod, and but a sparse covering of vegetation on the clay soil and gravel—no place for larva. The results of our collecting seem to prove that grass is absolutely necessary to produce numerous specimens. The imagos of *L. arcuata* I found perfectly colored and matured in October, 1887, and the date of their first appearance in 1888—April 30—was coincident with the first really warm day of spring.

With this description of localities the references hereafter will be more easily understood.

The captures of an evening were carefully overhauled next morning, every specimen being examined for sex and variations, and many of each lot being examined as to genital structure to discover possible variations in these structures. Especially was I careful to examine all those offering any superficial variations in any direction. As already stated, none were discovered; they were absolutely constant.

I shall first give the collections by dates, and afterward a list of the species, with localities and dates of capture, and relative abundance.

April 30.—A very hot day. Beetles appeared for the first time this season, beginning to fly early and everywhere. Observed them in great numbers on the young maples in front of the house, and found them mostly females. None were preserved, and no notes were made.

Following this unusually hot day, which brought out everything, there came a week of unpleasant weather, during which no collecting was done, and but few specimens were flying. I noted, however, late in the week that the blossoms of my pear trees began to drop, and on examination found that on most of them there were little notches bitten out of the flower stem, preventing of course the setting of the fruit. This damage I traced to *Lachnosterna*, and thereafter waged war against them. I observed that they flew freely early in the evening, and settled down to work when it became dark, flying little afterward; therefore, if I cleared my trees by shaking into an umbrella after it was fully dark, they were safe for the balance of the night. Warm, sultry evenings they were most active, and on one occasion, coming home near midnight, I heard them in my hedges and on the small maples buzzing and occasionally flying.

On this point—flying—it may be interesting to note that Mr. Schwarz and myself noticed that, as in the European Cockchafer, our species, before starting a flight, inflate the abdomen by rapidly expanding and contracting several times, expanding the wings meanwhile, and this is probably what causes the preliminary buzzing noticed in the evening before the steady hum of flight.

May 6.—Detailed memorandum lost. The note says: "The small number of specimens is accounted for by the capacity of the collecting bottle. *Hirticula* came first, before it was quite dark; with it, *micans; fusca* came last. This *fusca* is the form afterward made out as distinct under the term *arcuata*. In future I will use the latter term.

May 7.—Lanier Heights. *L. arcuata*, 144 ♂, 121 ♀; *L. hirticula*, 11 ♂, 32 ♀; *L. tristis*, 1 ♂, 1 ♀ (in cop.); *L. micans*, 1 ♀; *L. affinis*, 3 ♀; *L. inversa*, 1 ♀.

At the pear trees the collection was made without light. *Hirticula*, *micans*, and *tristis* came at about the same time. I believe the *affinis* and *inversa* were also taken early, flying from the oaks at the foot of the hill. Later the specimens taken on privet and wisteria were almost without exception *arcuata*. They would commence to eat the most tender tips first, but never ate much. Some would take little bites out of

the stalks, which turned black next day, and the twig afterward withered. The series of *arcuata* showed in the male a considerable, though gradual, variation in size, the ventral character remaining identical. The depression on the last segment is oval, O-shaped, the upper end encroaching on the penultimate segment, the crest of the ridge distinct and overhanging. Smaller specimens had the character most intensified. Four distinct forms were separable, fairly defined, yet with intermediate forms.

(1) A large, darker, robust, heavily punctured form, with discolored ventricose abdomen, and very firm elytra.

(2) The ordinary smooth form, varying in color, and often fully as dark as the preceding. Elytra softer, abdomen paler, form less ventricose in both sexes.

(3) A robust brown form, considerably smaller than the preceding, but proportionately broader. The punctuation is distinct.

(4) A still smaller, parallel form, which I thought at first might be different. It varies from castaneous to piceous, and the elytral punctuation tends to become rugulose; in one specimen it is so.

May 8.—At Lanier Heights. A chilly night; but few specimens flying. *L. arcuata*, 65 ♂, 19 ♀; *L. hirticula*, 6 ♂, 6 ♀; *L. affinis*, 1 ♀.

There was nothing in *arcuata* not previously noted. Two only of the forms taken yesterday were distinguishable in this lot in both sexes. The small specimens still uniformly have the ventral characters best marked.

May 9.—At Lanier Heights. Somewhat sultry, but a chilly, moist wind. Insects abundant early in the evening; at 9.30 very few were found on the trees and hedges. There was no reserve to take the place of those captured my me. *L. arcuata*, 156 ♂, 68 ♀; *L. hirticula*, 18 ♂, 28 ♀; *L. inversa*, 1 ♂, 1 ♀; *L. affinis*, 1 ♂, 1 ♀.

May 10.—At Lanier Heights. A cloudy, chilly evening. Mr. C. H. Roberts with me. *L. arcuata*, 176 ♂, 190 ♀; *L. hirticula*, 19 ♂, 46 ♀; *L. affinis*, 7 ♂, 2 ♀; *L. micans*, 2 ♀.

May 11.—Lanier Heights. Mr. Roberts and myself took: *L. arcuata*, 30 ♂, 26 ♀; *L. hirticula*, 5 ♂, 3 ♀, *L. micans*, 2 ♂, 2 ♀; *L. inversa*, 1 ♂, 1 ♀; *L. affinis*, 1 ♂.

On this date I received also the first specimen of *L. crenulata*, said to have been very numerous and destructive to Roses, a few miles from Washington.

May 12.—At Lanier Heights with Mr. Roberts. *L. arcuata*, 77 ♂, 106 ♀; *L. ilicis*, 1 ♂; *L. micans*, 1 ♂; *L. inversa*, 2 ♂, 1 ♀; *L. hirticula*, 3 ♂, 7 ♀; *L. affinis*, 3 ♂, 1 ♀.

The evening was dull, close, and yet cold, and the collections were chiefly on pear.

May 13.—At Lanier Heights, with Mr. Roberts. Evening chilly, with quite heavy rains later. Very little flying. *L. arcuata*, 9 ♂, 3 ♀; *L. hirticula*, 2 ♂. 3 ♀; *L. inversa*, 1 ♀.

In the afternoon of this day I picked up the first specimen of *L. fraterna* ♀, on the road.

May 14.—Cold and rainy. No beetles flying and none came to light.

May 15.—The same conditions prevailed.

May 16.—Chilly, yet close. No rain. Mr. Roberts and myself went down into Rock Creek Valley, but neither saw nor heard a specimen. The blackberries are just beginning to bloom but attracted nothing. Returning, we found on the pear trees *L. arcuata*, 1 ♂, 2 ♀.

May 17.—On the Department of Agriculture grounds, the party consisting of Messrs. Schwarz, Pergande, Roberts, and myself. The evening was cool and threatening, but it did not rain.

The result of the combined collections was: *L. arcuata*, 367 ♂, 164 ♀; *L. inversa*, 230 ♂, 107 ♀; *L. hirticula*, 57 ♂, 43 ♀; *L. micans*, 3 ♂; *L. fraterna*, 2 ♂; *L. hornii*, 1 ♀; in all, 974 specimens. Mr. Roberts kindly assisted me in sorting this catch. Oaks and hickorys were beaten, the oaks giving the *fraterna* and *hornii*. The *fraterna* here taken, by the bye, is the form determined as *forsteri* by Dr. Horn, and to this form his paper led me in the determination. After-study convinced me that the specimens taken on the Agricultural grounds were really of a distinct species. As I did not make this discovery until after the collecting season was over, I can not say exactly what specimens are *fraterna* and what the new species as they are referred to in my notes. I shall therefore make no effort to distinguish here, but will call every thing *fraterna* that then seemed to be such.

The time spent was about one and one-half hours, and the capacity of the bottles determined the cessation of the collection.

May 18.—Lanier Heights with Mr. Roberts. The oaks at the foot of the hill were visited and gave: *L. fraterna*, 2 ♂; *L. micans*, 3 ♂. On privet and pear we took: *L. arcuata*, 7 ♂, 7 ♀; *L. hirticula*, 3 ♂.

May 20.—Lanier Heights with Mr. Roberts. The oaks at the foot of the hill were again visited; the night was damp, chilly, and moonlit. *L. arcuata*, 3 ♂, 1 ♀; *L. hirticula*, 13 ♂, 4 ♀; *L. tristis*, 3 ♂; *L. affinis*, 4 ♂, 5 ♀; *L. inversa*, 2 ♂, 2 ♀.

The *affinis* with one exception were from the same tree; the others close by, gave principally *hirticula*; *inversa* scattered; the *tristis* were on the same tree with *affinis*.

The ground was full of *hirticula*, buzzing in every direction. No more were taken by us because they flew to the high branches, which were not easily reached. Nothing was found either on pear or on privet.

May 22.—At the Department of Agriculture, Messrs. Schwarz, Pergande, Alwood, and myself. Night cool and cloudy: oak, hickory, and hazel were beaten and proved almost equally productive. *L. tristis*, 1 ♀; *L. hornii*, 1 ♂; *L. fraterna*, 3 ♂; *L. hirticula*, 64 ♂, 42 ♀; *L. arcuata*, 146 ♂, 191 ♀; *L. inversa*, 137 ♂, 145 ♀; in all, 733 specimens. The principal flight seems over. It is noteworthy that the character

of the fauna remains the same; there is no addition or subtraction of species.

May 26.—At Lanier Heights took about 39 specimens of *arcuata*, and nearly all females. Previous evenings had not been favorable for collecting, and only a few specimens flew to light, and were not noted.

May 27.—At Lanier Heights. Collection was from pear, and quite a number on the succulent weeds of my lower terrace, which I had allowed to run wild. *L. arcuata*, 17 ♂; 51 ♀; *L. inversa*, 1 ♂, 1 ♀; *L. hirticula*, 4 ♂, 4 ♀; *L. tristis*, 1 ♀.

The preponderance of the females at this time is worthy of note. On this date Mr. Ulke found *crenulata* for the first time at the electric lights.

May 28.—At Lanier Heights. Night hot and close, *Photinus pyralis* appearing in numbers. *L. micans*, 1 ♀; *L. affinis*, 1 ♂, 1 ♀; *L. hirticula*, 1 ♀; *L. arcuata*, 25 ♂, 50 ♀.

This same evening Messrs. Schwarz and Pergande collected in the Department grounds, keeping the result of beatings on oak and hickory separate. On oak, *L. hirticula*, 4 ♂, 3 ♀; *L. arcuata*, 27 ♂, 46 ♀; *L. inversa*, 16 ♂, 24 ♀. On hickory, *L. hornii*, 2 ♂, 2 ♀; *L. gibbosa*, 1 ♀; *L. inversa*, 72 ♂, 93 ♀; *L. arcuata*, 74 ♂, 138 ♀; in all, 513 specimens. *L. gibbosa* is for the first time added to the list of species.

May 29.—In order to test whether the same species would be found under different circumstances, we decided upon a trip to the Virginia shore of the Potomac just above Washington, collecting along the crest of the hills there. The result was quite gratifying, showing that a variety of food plants is apparently necessary for a variety of species, and that perhaps the larvæ are not indiscriminate feeders. Messrs. Schwarz, Pergande, Alwood, Heideman, and myself constituted the party. Every tree and shrub was beaten, though we found oak, hickory, and persimmon as most fruitful. The captures were: *L. hirticula*, 24 ♂, 34 ♀; *L. micans*, 1 ♂, 5 ♀; *L. inversa*, 1 ♂, 3 ♀; *L. ilicis*, 2 ♂; *L. crenulata*, 6 ♂, 5 ♀; *L. fraterna*, 3 ♀; *L. gibbosa*, 1 ♂, 1 ♀; *L. tristis*, 9 ♂, 17 ♀; *L. arcuata*, 5 ♂, 6 ♀; *L. dubia*, 1 ♂. This is the greatest number of species taken on any one night. In addition there were a number of *Serica* (2 species), *Chalepus*, *Ligyrus*, and *Macrodactylus*.

Sumach, which on Long Island I had found excellent for *Serica*, yielded nothing. Blackberry blossoms, on which I had taken *crenulata* by the hundreds on Long Island, also proved unattractive here, while persimmon proved quite unexpectedly fruitful of specimens.

June 3.—Rock Creek Valley. Mr. Schwarz and myself. Cool and damp, little insect life stirring. *L. affinis*, 1 ♂, 1 ♀; *L. fraterna*, 1 ♂; *L. inversa*, 3 ♀; *L. arcuata*, 5 ♂, 4 ♀; *L. hirticula*, 1 ♂, 1 ♀.

Of the *affinis* the ♂ was taken on persimmon and the 2 ♀ on the old oak upon which most of the other specimens were found.

June 4.—Virginia. Mr. Schwarz, Mr. Alwood, and myself. *L. inversa*, 1 ♀; *L. arcuata*, 1 ♂, 1 ♀; *L. crenulata*, 2 ♀; *L. fraterna*, 1 ♂, 6 ♀; *L. micans*, 1 ♂, 7 ♀; *L. hirticula*, 17 ♂, 24 ♀. Many of these

were on persimmon, while, as on the previous occasion, neither sumach nor blackberry yielded anything.

On the way to our collecting ground we picked out of a fountain: *L. hornii*, 1 ♀; *L. gibbosa*, 1 ♂.

June 9.—Rock Creek Valley. Mr. Schwarz, Mr. Alwood, and myself.

The results are poor. *L. affinis*, 1 ♂; *L. inversa*, 1 ♂, 5 ♀; *L. tristis*, 1 ♀; *L. hirticula*, 8 ♂, 17 ♀; *L. fraterna*, 2 ♀; *L. micans*, 7 ♂, 6 ♀; *L. arcuata*, 6 ♂, 25 ♀.

The night was one in every respect favorable, the location so far as trees are concerned could not be better, but the sod is poor, grass thin, and indeed very little true grass at all. This seems to point strongly to the reason why the Department grounds proved such an excellent locality.

Persimmon seems a favorite here. On my pear trees a very few *arcuata* were found. Since our last Virginia trip, the electric light fauna has changed. The species of *Lachnosterna* are now generally replaced by *Chalepus* and *Ligyrus*, while *Diplotaxis* is not rare.

The nights from the 10th to the 13th, inclusive, were cold and windy, and nothing but a few *arcuata* and *hirticula*, and an occasional *inversa*, ventured out.

At this point the notes cease. From this time to the end of the month almost every moment of my time, both day and evening, was taken up in work on the exhibit collection for the Cincinnati Exposition, three months' work being crowded into three weeks. One other trip to the Department grounds was made by Mr. Schwarz and myself, developing nothing new. Into my window at Lanier Heights a few specimens found their way, attracted by the light, but they were not numerous.

On June 30, I left for Cincinnati, returning about the 10th of July. Mr. Schwarz and myself then made another trip to the Department of Agriculture grounds, turning up a few specimens of *gracilis* only. This species was new to me, not having been seen at all before I left.

Mr. Ulke, who continued collecting at the electric lights, reports the first arrival of *ephilida* and *gracilis* on July 17, the former rarely, the latter abundantly. On July 19 the last *fraterna* was taken at light. On August 6 one specimen each of *quercus* and *gracilis* appeared, and on August 8 one specimen of *ephilida*. This closes the record.

Mr. Ulke also took *L. marginalis*, *L. villifrons*, and *L. balia* at light; we found none in beating.

This record gives approximately the local material at hand, all of which was carefully studied in the preparation of this paper. In the form of a list the following were taken in and around the city of Washington during the season of 1888, as set out above:

Lachnosterna ephilida Say.
gracilis Burm.

Lachnosterna gibbosa Burm.
affinis Lec.

Lachnosterna inversa Horn.
micans Knoch.
arcuata Smith.
dubia Smith.
marginalis Lec. (fide Ulke).
fraterna Harris.
nova Smith.
hirsuta Knoch (fide Ulke)

Lachnosterna villifrons Lec. (fide Ulke).
balia Say (fide Ulke).
hirticula Knoch.
ilicis Knoch.
hornii Smith.
crenulata Fröhl.
quercus Knoch (fide Ulke).
tristis Fabr.

In all, twenty species, four of them heretofore undescribed or not recognized as distinct. There is no reason why other localities should not do as well, and I am firmly convinced that there are still many new species to be discovered.

To this list of species occurring in the District of Columbia must be added the following, represented in the local collections:

Lachnosterna congrua Lec. (Coll. Ulke); grandis Smith (Coll. div.); luctuosa Horn (Coll. Schwarz); profunda Blanch (Coll. Ulke); parvidens Lec. (Coll. Ulke).

This gives a total of twenty-five species, a rather disproportionate representation of the total number for so small a territory in so widely distributed a genus as *Lachnosterna*, and it indicates a considerable addition to the number of species when careful collections shall have been made. These collections Dr. Horn's paper have made possible, and it well illustrates the peculiar and intuitive perception of relationships so marked in the doctor's work that nearly all of his groups turn out to be perfectly natural after the study of the genital organs.

To the kindness of Mr. Westcott, of Chicago, I owe a chance to examine some of the catch recorded in an 1888 number of Entomologica Americana, and among them I found the following: *Lachnosterna gibbosa*, 230 ♂, 2 ♀; *Lachnosterna dubia*, 10 ♂; *Lachnosterna fusca*, 53 ♂, 2 ♀; *Lachnosterna grandis*, 1 ♂.

The preponderance of the males is easily explained by the fact that these collections were all made at light, and the males are always very much more numerously attracted than the females.

To the kindness of Mr. Ulke I owe a large lot of specimens collected at the electric light at Cleveland, Ohio, and these proved all of one species—the true *fusca*. There were 150 males and 74 females.

NOTES ON THE SPECIES, PRINCIPALLY IN THE MUSEUM COLLECTION.

1. L. lanceolata Say.

We have numerous specimens, ♂ and ♀: Texas (Coll. Riley and Smith), Kansas (Coll. Riley and Smith), New Mexico (Coll. Smith), Colorado, July (Riley), Missouri (Riley).

Our Kansas specimens are decidedly paler than the specimens from the other localities, and do not seem to be immature. Mr. Ulke's collection has specimens from Nebraska and Dakota.

The genitalia of both sexes are shown at Pl. XLVIII, fig. 1. They are extremely simple, and resemble closely the forms found at the extreme

end of the series. In the male the claspers are symmetrical, and are completely united, forming an entire circle. In the female, there is only a single pair of corneous plates.*

2. L. cribrosa Lec., 4 ♂, 3 ♂.

All from Belfrage, Tex. (Coll. Riley.) Mr. Ulke has it from Arizona.

In this species the genitalia are somewhat more distinctive in both sexes. In the male the claspers are still united along the front, but they are more characteristic, and in the female the two pair of plates are distinct.

In addition to the differences noted by Dr. Horn, the females in our collection are rather stouter, more ventricose than the males.

3. L. æqualis Lec.

Not in our collection; Dr. Horn says it was a unique from El Paso, Tex. It is not in his collection, and I have been unable to obtain any specimen for study.

4. L. farcta Lec.

Several specimens of both sexes, all from Texas, and mostly collected by Belfrage. (Coll. Riley and Smith.) Two of the specimens are dated April 27.

The genitalia of both sexes are figured, Pl. XLVIII, fig. 4. They differ in the male, in that the claspers are well separated in front though not at all mobile, being completely united posteriorly. The sides are perfectly symmetrical. In the female the upper plates are united, and form a representative of the public process.

5. L. torta Lec.

There are 8 ♂ and 2 ♀ in the collection, all of them from Texas. (Coll. Riley and J. B. Smith.) One specimen is marked Dallas, Tex.

Mr. Ulke's collection contains a specimen from New Mexico; Mr. Schwarz has the species from Columbus, Tex., July 9. It seems a late flyer.

The genitalia in both sexes are well developed. In the ♂ they are symmetrical, united by a single point in front. The ♀ has the superior plates united, forming a pseudo-pubic process.

No variations not recorded by Dr. Horn were observed.

6. L. hamata Horn.

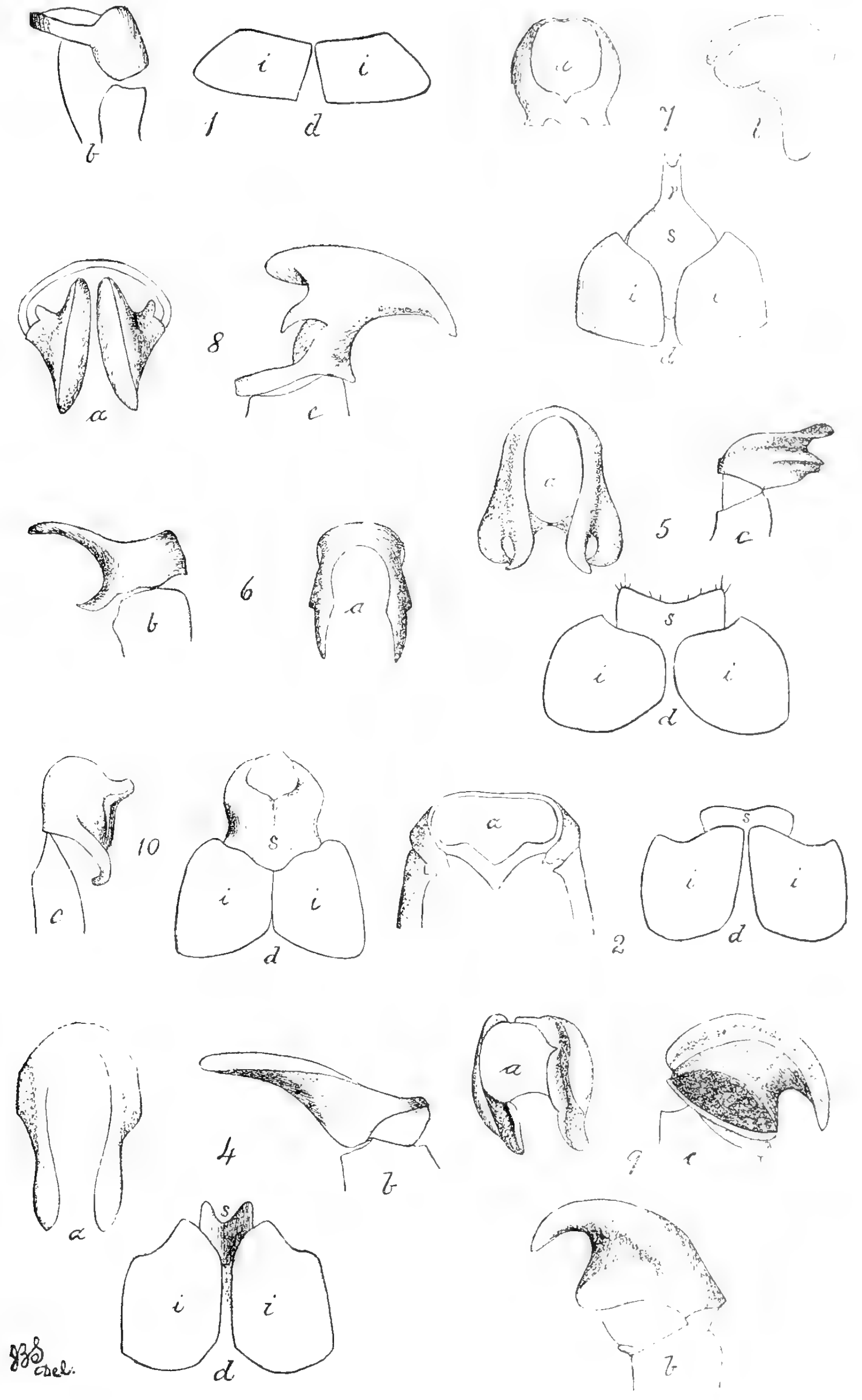
Not in our collection. The type is a unique ♂ from Texas, in the collection of Dr. Horn.

The genitalia, which Dr. Horn kindly allowed me to extract from the ♂, are symmetrical, somewhat more simple than in *torta*, but the claspers perfectly free in front, though so united as to be immobile.

7. L. latifrons Lec.

A few specimens, mostly ♂, are in our collection, two of them donated by Mr. Schwarz, the others retained from lots received for determina-

*As this paper is intended to be rather supplementary to Dr. Horn's Revision, none of the matters referred to by the Doctor will be touched upon here except where necessary.



SEXUAL CHARACTERS OF LACHNOSTERNA.

1. *L. lanceolata*, ♂ and ♀.
2. *L. cribrosa*, ♂ and ♀.
4. *L. farcta*, ♂ and ♀.
5. *L. torta*, ♂ and ♀.
6. *L. hamata*, ♂.
7. *L. latifrons*, ♂ and ♀.
8. *L. generosa*.
9. *L. prætermissa*.
10. *L. prununculina*, ♂ and ♀.

(Explanation of plate on page 524.)

tion. There is quite a difference in the coloration of the specimens seen, though none in other directions.

All the specimens are from Florida. Mr. Schwarz has the following dates: Biscayne, May 19, 21; Enterprise, May 24; Lake Harney, May 4.

The genitalia of the ♂ are distinctly united in front, and more simple than in the immediately preceding species. The ♀, on the contrary, is very characteristic, and much more strongly developed as to genitalia than the simple characters of the ♂ would seem to indicate. The inferior plates are well developed, and the superior plates and pubic process are fused into one piece. It is really a modification of the superior plates, which are united on the median line.

8. L. generosa Horn.

Not in our collection. Dr. Horn had only a single ♂ specimen from Texas, and from this he allowed me to study the genitalia. These are symmetrical, the claspers not united in front, and somewhat unique in shape. The species seems rare, and so far I have not seen any other specimen.

9. L. praetermissa Horn.

Not in our collection. The species (♂ only) was collected by Morrison in Louisiana, but none were in the collection obtained by the Museum. From a specimen loaned by Dr. Horn the genitalia were studied, and are of decided interest as the first showing marked asymmetry of the claspers and partial mobility. Three figures are given showing the claspers from above and from each side. Quite a different place for this species would seem to be indicated by this structure.

10. L. prununculina Burm.

Five specimens are in the collection: 1 ♂ (Florida, coll. J. B. Smith); 4 ♀ (Georgia, coll. Riley and J. B. Smith). The male is reddish brown, shining; the females are all blackish, opaque, with slight iridescence.

Mr. Schwarz has it from Tampa, Fla., April 28, and Crescent City, Fla., June 8—an unusually long period for the species. Mr. Ulke's collection contains specimens from Virginia, the most northern point thus far recorded.

The genitalia of both sexes are distinctive. In the male they are symmetrical, the claspers immobile. They are peculiar by the vertical development. In the female the superior plates are very strongly modified, forming a very obvious lead to some of the strongly developed forms of the *rugosa* group.

11. L. glaberrima Blanch.

Males and females in the collection. Cedar Keys, Fla., June 6 (coll. C. V. R.), 2 ♂; Florida (coll. J. B. S.), 1 ♂; Kentucky, 1 ♀ (coll. J. B. S.); Delaware (coll. J. B. S.), 1 ♂; New Jersey (coll. C. V. R.), 1 ♀;

Coney Island, N. Y. (coll. J. B. S.), 1 ♂, 1 ♀. The Coney Island specimens may well be from New Jersey, having been found on the beach. Mr. Schwarz has the species from Capron, Fla., April 14, 22; Enterprise, May 21; Cedar Keys, June 5, 6. Mr. Ulke has specimens from Florida, Maryland, New York, Illinois. Dr. Horn gives "Pennsylvania to Florida" as the range of the species.

In genital structure this species approaches the preceding. In the male the claspers are symmetrical, free, and developed in the same vertical direction noticeable in *prununculina*. The female characters are much less strongly developed, though in the same line as in the previous species. The figures are left to explain the differences.

12. L. ephilida Say.

Males and females are in the collection. Louisiana (coll. J. B. S.), 4 ♂; Kansas (coll. C. V. R., from Morrison), 5 ♂; Pennsylvania (coll. C. V. R.), 1 ♂, 2 ♀; District of Columbia (Museum coll.), many specimens of each sex. For dates of the local collections see the introductory remarks. In Mr. Schwarz's collection is a specimen marked July 26; Mr. Ulke took it in August, and the species is probably the last to disappear, as it is one of the latest in making its appearance.

The specimens from Louisiana are decidedly larger than the others, and very uniform in general appearance.

The genitalia of both sexes are peculiar. Those of the male are unusually large, symmetrical, free in front. In the female the superior plates are lost, or merged into a long, stout, conic process—altogether a peculiar structure. The species may not be widely distributed in Texas, since the Belfrage collection contained no specimens from that State.

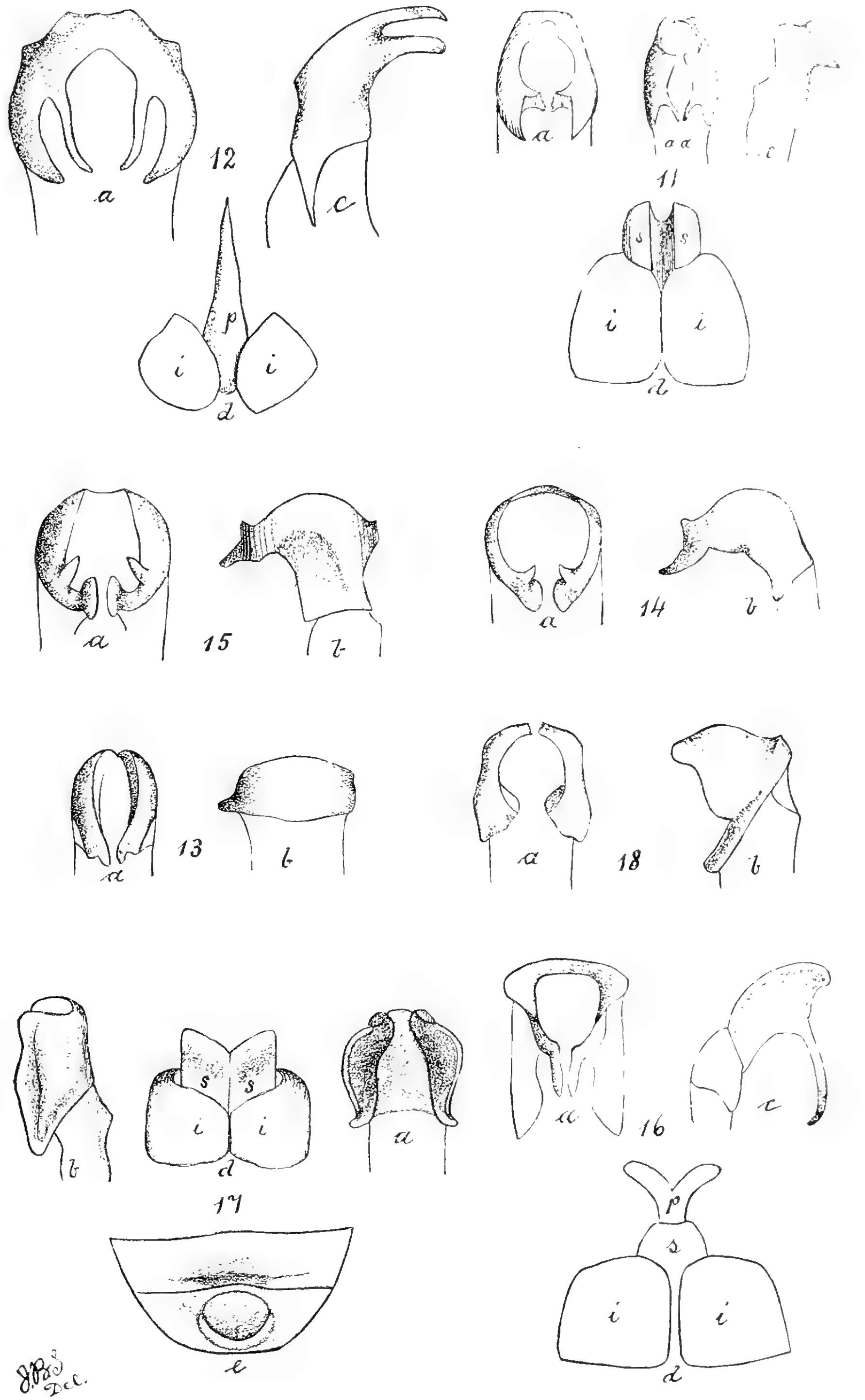
13. L. longitarsus Say.

Two specimens in our collection, both ♂, retained from material sent for name. The specimens are not good, and offer nothing peculiar. The genitalia are simple, symmetrical, and free anteriorly. No ♀ could be obtained for dissections. No localities not covered by Dr. Horn's statements as to distribution have been noted by me.

14. L. clemens Horn.

One ♂ (coll. C. V. R.) from New Jersey is in our collection, from the Belfrage material. Dr. Horn gives Florida and Texas as localities. It is barely possible that the specimen from the Belfrage material was really collected in Texas, but I doubt it. The specimen is not mounted on a Belfrage pin, and has not the almost universal date label of that collection. It would give the species a wide distribution, however, if it should be so, it becomes strange that no specimens from intervening localities have been found.

The genitalia of the ♂ are symmetrical, free anteriorly. The ♀ has not been obtainable by me. The single specimen in the Museum collection was named by Dr. Horn.



SEXUAL CHARACTERS OF LACHNOSTERNA.

11. *L. glaberrima*, ♂ and ♀.
12. *L. ephilida*, ♂ and ♀.
13. *L. longitarsus*, ♂.
14. *L. clemens*, ♂.
15. *L. dispar*, ♂.
16. *L. gracilis*, ♂ and ♀.
17. *L. gibbosa*, ♂ and ♀.
18. *L. hirtiventris*, ♂.

(Explanation of plate on page 524.)

15. L. dispar Burm.

Three ♂ specimens, all from Florida (coll. C. V. R.). Mr. Schwarz has it from Enterprise, Fla., May 7–20, June 9; Lake Harney, Fla., May 4.

In genital structure this species most remarkably resembles the preceding in general type, differing only somewhat in details. The species seems not at all common.

16. L. gracilis Burm.

Many specimens, ♂ and ♀. New York (coll. C. V. R. and J. B. S.), 4 ♂, 1 ♀; New Jersey (coll. C. V. R.), 1 ♂; Pennsylvania (coll. J. B. S.), 1 ♀; North Carolina (coll. C. V. R.), 1 ♀; Louisiana (coll. C. V. R.), 1 ♂ (the North Carolina and Louisiana specimens collected by Morrison). District of Columbia, many specimens, collected for the Museum; for dates, etc., see introductory remarks.

Mr. Schwarz collected it also at Detroit, Mich. This species becomes common rather late in the season and is easily recognized, offering little or no variation except in size.

The genital structure in both sexes is distinctive. The claspers of the ♂ are symmetrical, free anteriorly, with an unusually long curved process. In the ♀, the true pubic process becomes well marked for the first time, the superior plates united, forming the base upon which it rests.

17. L. gibbosa Burm.

Numerous specimens of both sexes. New York (coll. J. B. S.), 5 ♂, 8 ♀; Pennsylvania (coll. J. B. S.), 3 ♂; northern Illinois (coll. C. V. R.), 4 ♂; Detroit, Mich. (coll. C. V. R.), 1 ♂; Minnesota (coll. J. B. S.), 1 ♂, 3 ♀; Nebraska (coll. J. B. S.), 4 ♂; Douglass County, Kans., 9,000 feet (coll. C. V. R.), 1 ♂; Texas (coll. C. V. R.), 1 ♂, 1 ♀; Virginia, June 12 (coll. C. V. R.), 1 ♀; District of Columbia, many specimens, collected for the Museum.

Only the slight color variations indicated by Dr. Horn appear in this series, and there seems to be no racial or geographical modification whatever.

The genitalia of the ♂ approach the type of *glaberrima* and *prununculina*, by the vertical direction of the claspers. In the ♀ the superior plates are more normal, and are divided, still however serving as pubic process. The ventral characters of the ♂ are also figured, a well-marked specimen having been chosen.

18. L. hirtiventris Horn.

A single ♂ specimen from Dallas, Tex. (coll. J. B. S.). This seems rather a rare species in collections. The genitalia of the ♂ are distinctive, symmetrical, free anteriorly, and better described by the figure than is possible by words.

Sept. 3, 1889.

19. L. congrua Lec.

The collection contains 18 ♂, 6 ♀. Texas (coll. C. V. R. and J. B. S.), 9 ♂, 6 ♀; Louisiana (coll. J. B. S.), 6 ♂; Missouri (coll. C. V. R.), 3 ♂.

Dr. Horn had no ♀ before him when he wrote. That sex offers nothing at all peculiar, and differs from the ♂ only in the lack of ventral characters, and in the shorter antennal club. In the series before me there is a very marked tendency towards a darkening of the thoracic disk, accompanied by a corresponding paling of the margin. The Texan specimens are, as a whole, much paler in color and considerably smaller (15^{mm} to 19^{mm}). The difference is scarcely racial, however, because one of the Texan specimens is fully as large, and even darker than the most fully developed of the Louisiana forms.

The genitalia in both sexes are distinctive. In the ♂ the claspers are symmetrical, free anteriorly, and tending to a vertical direction. In the ♀ the tendency is again to the modification of the superior plates into the pubic process.

20. L. postrema Horn.

Not in our collection; described from a single ♂ specimen in Dr. Horn's collection, which he kindly allowed me to use.

The genitalia are distinctive, and are decidedly in the line of the *fusca* type. The claspers are decidedly unsymmetrical, and as suggested in the *fusca* group of characters. I have not been able to procure a ♀.

21. L. affinis Lec.

Many specimens, ♂ and ♀, most of them collected for the Museum in the District; 1 ♀, Kansas. Dr. Horn gives as localities Kansas, Colorado, Indian Territory, and Texas. Mr. Ulke has it also from Tennessee, and its occurrence in the District indicates a very wide distribution. The species is a very well marked one, and shows no apparent variation.

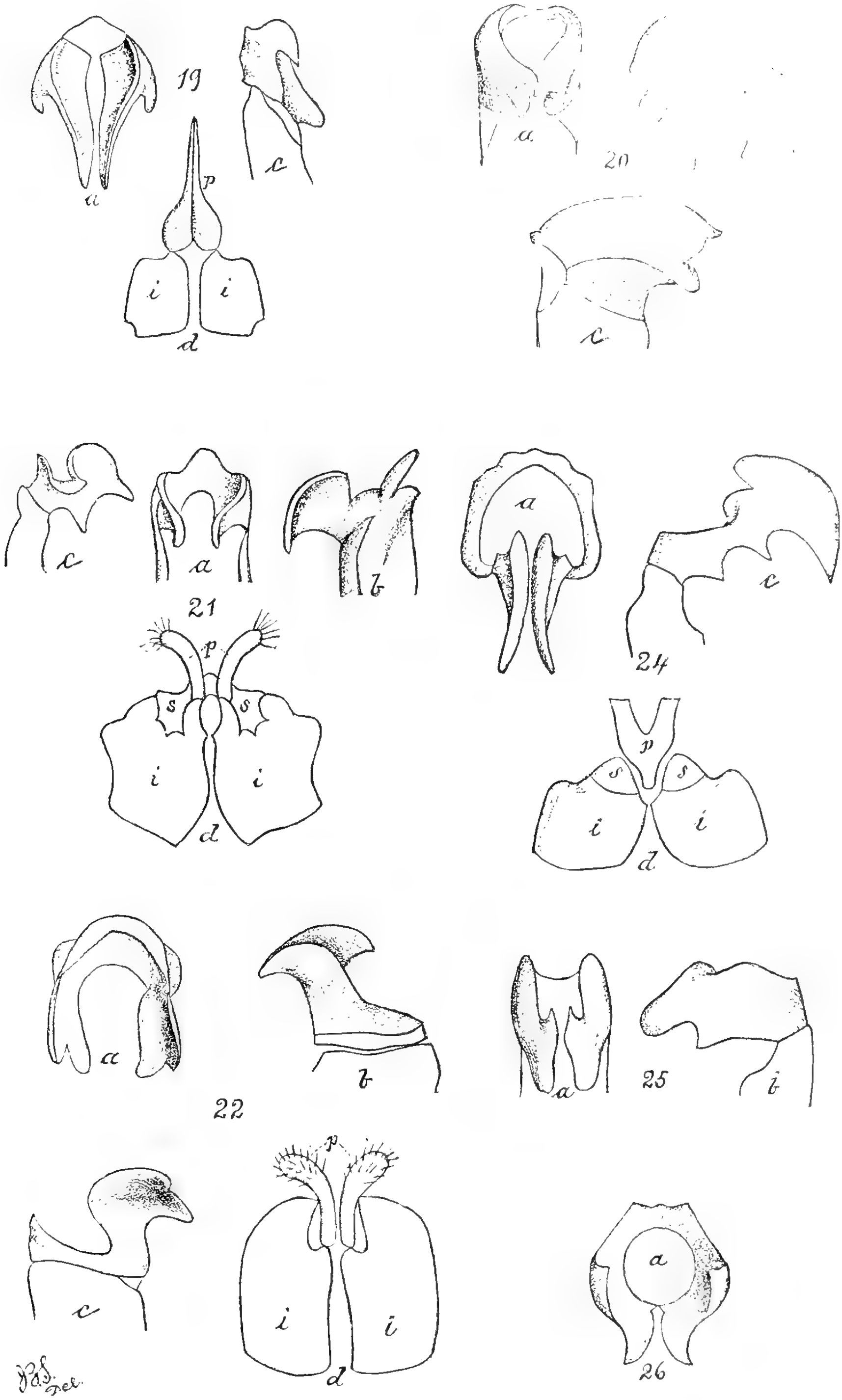
The ♂ genitalia are distinctly unsymmetrical, free in front, but immobile, being completely united behind. The ♀ characters are equally strong. The inferior plates distinctly notched and toothed to accommodate the superior plates, which are very much reduced in size, and act as a support to the double pubic process, which rests on spurs from the inferior plates.

It is likely that the species is local; it has proved so at least in the District of Columbia, as is noted in the introduction, to which reference is also made for dates, etc.

22. L. prunina Lec.

Numerous specimens, ♂ and ♀; 1 ♂, Texas (coll. C. V. R.); all the others from Constantine, Mich, collected by Mr. Tyler Townsend. Mr. Townsend informs me that he took all these on raspberry, early in the evening, and that they were very abundant. It seems to be local

PLATE L.



SEXUAL CHARACTERS OF LACHNOSTERNA.

19. *L. congrua*, ♂ and ♀.
20. *L. postrema*, ♂.
21. *L. affinis*, ♂ and ♀.
22. *L. prunina*, ♂ and ♀.
24. *L. crassisima*, ♂ and ♀.
25. *L. subpruinosa*, ♂.
26. *L. errans*, ♂.

(Explanation of plate on page 524.)

and not easily taken, judging from the small number of specimens in collections. There is absolutely no variation in the large series before me, save a slight difference in the intensity of the brown.

The genitalia are unsymmetrical in the ♂, the claspers very dissimilar. In the ♀ the superior claspers have become entirely modified into supports for the double pubic process, which is very like that of *affinis* in type, though very different in detail.

23. L. calceata Lec.

We have two ♀ specimens, "Gainesville, Tex., from the stomach of a chuck-will's-widow," May 12. The specimens are of course somewhat damaged, but quite recognizable.

Mr. Schwarz kindly let me have a ♂ specimen for dissection, but by some mishap the preparation was lost, and I can not find that I made even a sketch of it. The species seems rare.

24. L. crasissima Blanch.

We have 15 ♂ and 9 ♀. Texas (coll. C. V. R., J. B. S.), 9 ♂, 3 ♀ Arkansas (coll. J. B. S.), 2 ♂, 2 ♀; Kansas (coll. C. V. R., J. B. S.), 1; ♂, 2 ♀; Nebraska (J. B. S.), 1 ♂; Illinois (coll. J. B. S.), 1 ♀; New York (coll. J. B. S.), 1 ♀.

Dr. Horn gives from Kansas to Texas as localities. I am positive my New York specimen is correct, as it has my local label, and I am also very certain of my Illinois specimen. The species has therefore rather a wide distribution.

The genitalia are distinctive and differ quite considerably from the immediately preceding forms. They are in the ♂ symmetrical, and of a type quite similar to that of *generosa* in the early part of the series. The ♀, on the contrary, has both plates definitely developed, and the pubic process is characteristic, bifid but not double and somewhat flattened.

There is quite a distinct variation in the punctuation of the clypeus. In some specimens it is sparse, the punctures well separated, the intervals smooth, in others the punctures are fully as densely set as in specimens of *fraterna*.

As a rule the ♂ is smaller and paler. One of the ♀ from Arkansas measures .88 inches, larger than any specimen before Dr. Horn (.82 inches).

Otherwise the specimens are very constant and with very little variation in other respects.

25. L. subpruinosa Casey.

Three ♂ are in the collection (coll. J. B. S.) from Pennsylvania.

Dr. Horn says, "Taken near Jacksonville, Fla., by the late Edward Tatnall." The specimens now in the Museum collection were given me by Mr. H. W. Wenzel, and were collected by him in the vicinity of Philadelphia. Mr. Casey described the species from examples taken on Long Island or near it.

No variation appears in our specimens.

The genitalia are very like those of the *micans* type, and in the ♂ are symmetrical. No ♀ specimen has been at hand for study.

26. L. errans Lec.

There is one ♂ specimen from California in the Museum collection received from Mr. Ulke.

The ♂ characters of the species are simple. The claspers are symmetrical and contiguous, if not united in front. They are quite distinctive.

27. L. inversa Horn.

Numerous specimens— ♂ and ♀. Virginia (coll. J. B. S.), ♂, ♀; Illinois (coll. C. V. R., J. B. S.), 5 ♀; Tennessee (coll. C. V. R.), on Apple, May 24. For specimens from District of Columbia collected for the Museum, see dates, etc., in the introduction.

This species was one of the most common at Washington in 1888, and is easily recognizable. In the ♂ the ventral character is obvious; in the ♀ the species closely approaches *fusca—sensu lata*—and is distinguished from *arcuata* by the non-emarginate terminal ventral segment, and from *fusca*—strictly speaking—by the much more feebly spinose posterior tibia, there being no distinct rings of spines.

The genitalia are distinctive in both sexes. The claspers of the ♂ are decidedly dissimilar, and very strongly marked. The ♀ has the pubic process very characteristically developed, and the superior plates distinct. The figure must be referred to, to appreciate the structures. Dr. Horn did not have *inversa* from the District of Columbia, and I have not seen it from northern collections.

28. L. bipartita Horn.

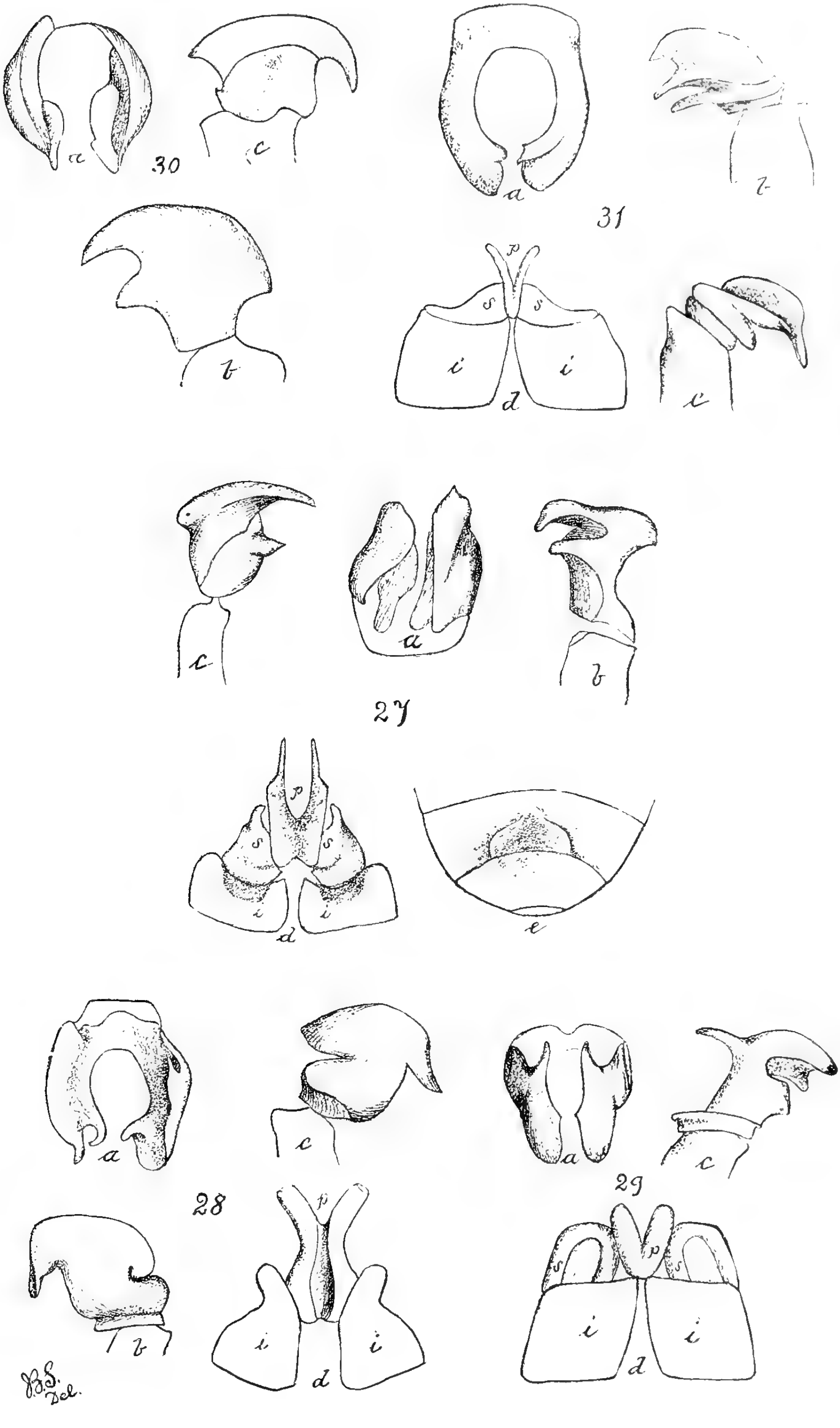
There are 12 ♂, 4 ♀ in the Museum collection. Louisiana, collected by Morrison, 11 ♂, 1 ♀; Tennessee (coll. C V. R.), 1 ♀; Kirkwood, Mo., April 16 (coll. C. V. R.), 1 ♂, 2 ♀. This considerably extends the northward and eastward range of the species as given by Dr. Horn. The specimens are very uniform in appearance.

The genitalia of the specimens examined are distinctive and peculiar by the twisted processes on the inner side of the clasper, which are more characteristic of a later division. In the ♀, also the pubic process is developed much more in the line of the *rugosa* group than of its immediate allies.

Some of the Kansas specimens examined from other collections indicate a new species with essentially the characters of the present, particularly as to the ventral segments of the ♂. It will require careful study of series from all localities to make certain of this. In Kansas, I think there are still many new species to be discovered.

29. L. micans Knoch.

There are numerous specimens of both sexes in the collection. Louisiana (coll. J. B. S. and Morrison), 26 ♂, 1 ♀; Tampa, Fla., March 30 (coll.



SEXUAL CHARACTERS OF LACHNOSTERNA.

27. *L. inversa*, ♂ and ♀.
28. *L. bipartita*, ♂ and ♀.
29. *L. micans*, ♂ and ♀.
30. *L. definita*, ♂.
31. *L. vehemens*, ♂ and ♀.

(Explanation of plate on page 524.)

C. V. R.), 2 ♂, 2 ♀; Missouri, May (coll. C. V. R.), 1 ♂, 1 ♀; New Jersey, New York, Pennsylvania (coll. J. B. S.), 4 ♂, 1 ♀; District of Columbia, large series collected for the Museum.

Florida is not given by Dr. Horn as a locality for this species. The species superficially is a very compact one; but on looking over a large series quite a decided variation of the sexual characters appears. The punctuation of the venter varies quite considerably, and the gibbous ridge of the penultimate segment of the ♂ may be very feeble, or quite prominent; may be close to the hind margin, or from near the front margin and strongly overhanging. The depression on the terminal segment is also variable in depth and extent; occasionally it forms a regular ∩, the closed upper part extending to the middle of the penultimate segment. The ♀ is equally variable; sometimes there is no trace of a depression in the last segment; in other specimens there will be a deep, semicircular depression with very well defined margins, which does not, however, extend to the penultimate segment.

The genitalia of both sexes are distinctive. In the ♂ the claspers are symmetrical and characteristic. In the ♀ the superior plates are peculiarly modified and sculptured, while the small, somewhat heart-shaped pubic process sets in between them.

30. L. definita Smith=*diffinis*‡ Horn.

Not in the Museum collection. Dr. Horn says that after examination of Blanchard's type, he finds that he had mistaken the species. Blanchard's *diffinis* is the *comans* of Burmeister, and has priority, while *diffinis* Horn thus becomes nameless. Dr. Horn kindly allowed me to study a ♂ specimen, from which the figures are made. The claspers are dissimilar, as usual, and are quite characteristic, resembling nothing in the near neighborhood very closely.

31. L. vehemens Horn.

There is a ♂ and ♀ from Kansas in the Museum collection. The angulation of the posterior femur of the ♂ is a strong character, as is also the peculiar curve of the tibial spur. In ventral characters it very closely approaches the species which I have named *dubia*. The ♀ is more difficult to distinguish from some of the *fusca* forms, but if the transverse impression of the penultimate segment is constant it may serve as an aid. Some specimens of the *fusca* series, however, also show this character, though not so well marked.

The genitalia of both sexes have been examined and also emphasize the affinity of the species. The claspers of the ♂ are dissimilar—less so when viewed from above, and quite characteristic. The ♀ approaches more nearly to the *grandis* type, but the pubic process is much reduced, cleft nearly to the base, while the superior plates are small.

L. FUSCA auct.

It is in this group that the greatest apparent difficulty in the identification of species is encountered. The forms of the typical species are

so variable and yet so strangely similar that after arranging a series to show all the differences in habitus, color, and other details in the strongest light, another series can be built up of precisely the same specimens to show that there is only one form.

The latter conclusion was the one arrived at by Dr. Horn in his study of *fusca*, and he pointed out both the differences that had been considered specific and racial, and the reasons for still considering them forms of the same species. Dr. Horn also pointed out some of the differences in the ventral characters, but considered them within the limits of variability, if even of varietal importance. The misleading character of the aggregation consists in the fact that all the species into which I have divided it vary in precisely the same manner, so that it is easy to obtain a series of specimens almost identical in all characters save those of the ventral segments of the male, and which yet represent at least six different species. Still Dr. Horn left the question somewhat unsettled, and open to future consideration. In the course of our collecting we first noticed the remarkable constancy of the ventral characters of the males of the species, or rather form of *fusca* taken by us, and from this began to consider that it might refer to a distinct species. When finally my attention was directed to the genitalia the suspicion became a certainty, and the true solution of the *fusca* problem became evident. The males, it was found, were thus easily to be separated; the females were in a different case; here there were no anal or ventral characters, and little or nothing in the way of superficial differences. An examination of the primary sexual characters showed, however, that the corelation found in the other species existed here as well, and that the species were well marked in both sexes.

In No. 6 of Insect Life I showed some of these differences, and gave figures of the characters relied upon. Since that time three other species, each coming under the definition of *fusca*, have developed. Of these, one was rather a surprise to me, coming from a region supposed to be well represented in local collections, viz, Snake Hill, New Jersey, while the others represented forms not seen by Dr. Horn and which would have been most probably recognized as distinct by him. The table of species allied to *fusca* as given in Insect Life must therefore be modified, and as the group *fusca* in the restricted sense becomes so much changed, a new table of the species is given.

I wish again to emphasize the fact already mentioned in Insect Life, that I have made no effort to identify the species here separated with the types described by previous authors. I simply had neither the opportunity nor the knowledge of types to enable me to do it. If, at some future time, older names will be identified with my species, I am content to drop my terms, believing that in defining the species I will have disarmed blame for the needless names, if they be such.

The following table includes all those species which agree in the char-

acters which would lead to *fusca* in Dr. Horn's table of species 24-32, on page 238 of his Revision:

Clypeus distinctly emarginate, the angles rounded.
- Ventral ridge of male small, well defined, strongly arcuate and overhanging, the ends at the extreme margin of the penultimate segment, and somewhat overhanging the penultimate segment .... *arcuata*
- Ventral ridge of male small, well defined, not overhanging, the ends, and indeed the entire ridge, near the middle of the segment .... *insperata*
- Ventral ridge of male longer, decidedly arcuate, but not so much as before, overhanging posteriorly for its full length, the ends at some distance from the posterior margin of the penultimate segment .... *dubia*
- Ventral ridge of male still longer, slightly curved, the ends overhanging posteriorly; centrally the ridge is declivous, but not overhanging behind .... *fusca*
- Ventral ridge of male elevated, nearly straight, not overhanging, scarcely declivous at ends; at center the posterior declivity nearly as gentle as the anterior .... *grandis*
- Ventral ridge of male not elevated, rigidly straight, and behind it an abrupt depression of the segment .... *ulkei*

Clypeus feebly emarginate, nearly quadrate, the angles not rounded .... *quadrata*

By this table the males may be distinguished without much trouble. The females are not so easily separated, yet may be in most cases associated with the males.

32. **L. arcuata** Smith.

This species, as a whole, averages rather smaller than either of the others. From *dubia* it does not, in the female, differ at all in superficial characters, every effort to discover any feature whereby specimens of this sex might be distinguished from each other having failed. As the genital structure is so distinct, this is somewhat surprising, and possibly the true character has been still overlooked.

The primary characters of the female are much as in *dubia*, and yet obviously different. The pubic process while divided at tip, much as in *dubia*, is only about one-half as long and does not divide the upper plates as in that species. It resembles the upper part of the *dubia* structure set upon the superior plates; these latter are large and nearly quadrate, in marked contrast with the narrow linear structures of *dubia*. The inferior plates differ as markedly, as can be readily seen by a comparison of the figures.

The males also in habitus do not differ from the allied species, except in ventral characters, but these are obvious and easily recognized. The ridge in this species is very much curved, very much overhanging, the ends reaching the apical margin of the segment, while the arch, combined with the depression of the last segment, forms a perfect oval.

In this species the space included by the arch of the ridge is smooth.

The species seems rather more southern than some of the others. It is practically the only form taken at Washington, many thousands being taken, while only one specimen of the other forms was discovered. Other localities are New York, New Jersey, central Missouri, Iowa,

Georgia. The specimens from New York and New Jersey are from my own collection, and form the small minority of the specimens taken. The specimens from central Missouri are from Professor Riley's collection, and the figures in the Missouri Reports, so extensively copied, probably represent this species.

33. **L. insperata** Smith.

Agrees very completely with Dr. Horn's description of *fusca*, and offering superficially no obvious differences. The ventral characters of the male resemble those of *dubia* and *arcuata*, the ridge being strongly arched and small, but situated back from the posterior margin ot the segment, and not overhanging the last ventral. In the female, I have found no distinctive characters. Six specimens, taken under stones early in spring by Mr. M. L. Linell, at Snake Hill, New Jersey, are before me—four of them males, two of them females. The specimens are dark in color, and large and stout, resembling most nearly the larger form of *fusca*, which occurs with it. The male character is recognizable, and I separated out the specimens from a lot of *fusca* at sight. The genitalia of both sexes bear out the intermediate position assigned by the ventral characters.

The claspers of the male are symmetrical—an unusual character—yet in structure combining the features of both *arcuata* and *dubia*. The female is equally characteristic—more nearly allied to *dubia* perhaps both in the form of the superior plates and the pubic process. The plates are larger than in *dubia*, but not nearly so well developed as in *arcuata*. Other differences will appear at a glance by a comparison of the figures.

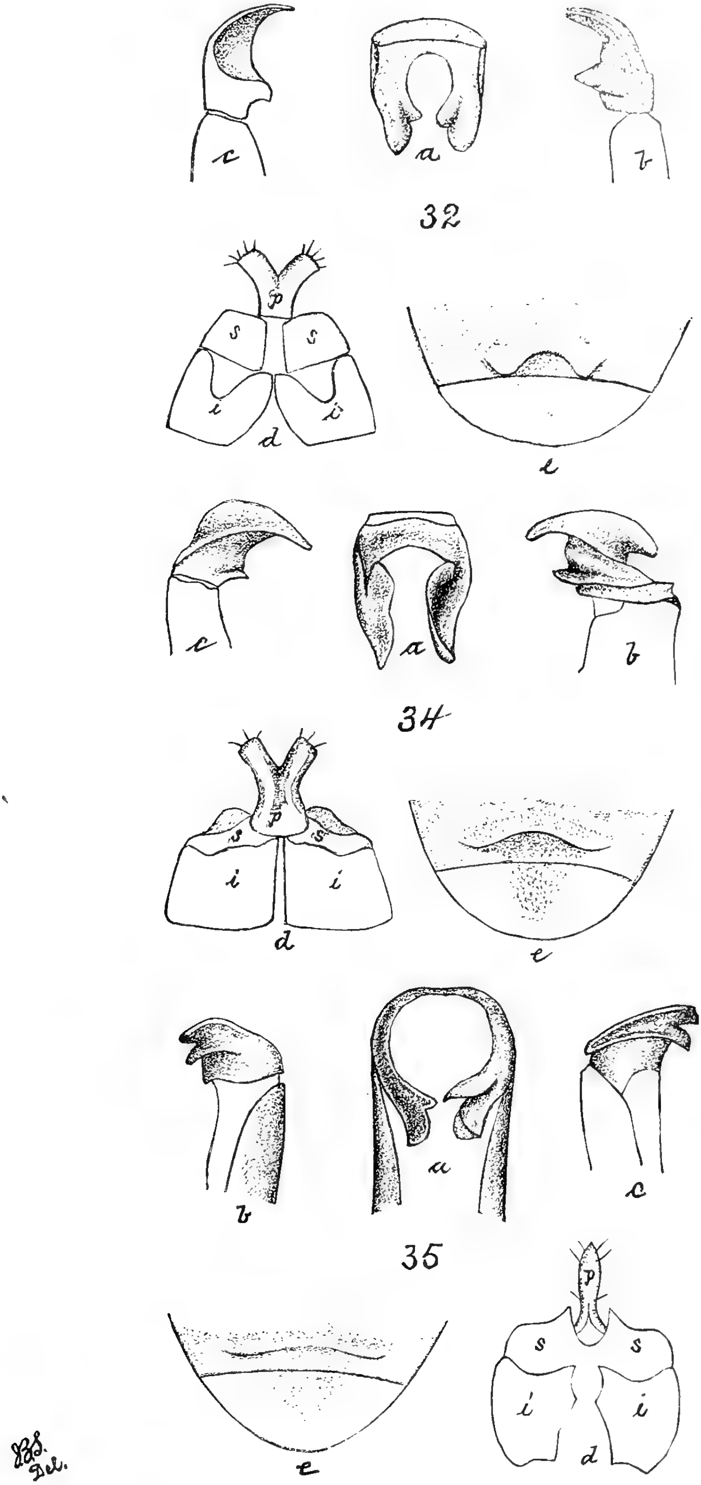
I was not quite prepared for this species, coming as it did from a region from which I had many specimens.* It well illustrates, however, how really slipshod much of the collecting is, even with "good" collectors.

34. **L. dubia** Smith.

Completely resembles *fusca* in all outward appearance and habitus. The ventral characters of the male must be resorted to for the identification of that sex. As appears from the figure, the ridge is decidedly less curved than in *arcuata*, and more curved than in *fusca*, and is in every respect more distinctly marked than the latter. The primary characters will show, on comparison with the following species, a considerable change of type, which should be followed by a corresponding change in external habitus, but if it is, we have not yet discovered it. In the female the differences of the male become emphasized. The pubic process is broad, stout, somewhat contracted medially, and divided superiorly into two branches which are broad, somewhat flattened, and obliquely truncate. The superior plates are narrow, linear.

This species is in the collection from Massachusetts, New York, New Jersey, Maine, North Carolina, District of Columbia, Illinois, Ohio,

* I have since received it from Chicago, Illinois (Westcott).



SEXUAL CHARACTERS OF LACHNOSTERNA.

32. *L. arcuata*, ♂ and ♀. 34. *L. dubia*, ♂ and ♀. 35. *L. fusca*, ♂ and ♀.

(Explanation of plate on page 524.)

Texas, Colorado, Tennessee, Nevada, Montana, California, Wisconsin. Of all the others this extends furthest west, and the race *cephalica* Lec. belongs to this species. It is fairly numerous at New York, formed a fair proportion of the specimens received from Chicago, Ill., from Mr. Westcott, but is rare at Washington, only a single specimen having been taken during the last season (1888).

35. **L. fusca** Fröhl.

This is the form which Dr. Horn suggests as likely to be the one seen by Fröhlich, and upon which he based his species. It offers no point of superficial difference from the preceding species, with which it agrees in form, color, size, and general habitus. The ventral character in the male must be examined to recognize that sex, and no difficulty will be found in this. The female is easily distinguished from all its allies by not having the last ventral segment emarginate. This character is at once obvious on examination, and the species is thus readily recognizable in both sexes. A comparison of the figures will show the change in type of genitalia from the preceding. The female shows the greater difference and is somewhat unique, the pubic process being subulate, slender, the superior plates coalescent on the median line.

This species is in the collection from Texas, New York, New Jersey, Ohio, Illinois, District of Columbia, Iowa.

It is the common form around New York City; was the only form found in a large lot of material from Cleveland, Ohio, and was represented in great proportion in a lot of specimens from the vicinity of Chicago, Ill. In the District of Columbia it is very rare, no specimens having been taken at all during the season of 1888, and only a few specimens from the locality are in the local collections.

36. **L. grandis** Smith.

This species is, as a whole, rather larger than either of the others and rather more robust. The sides of the thorax are very perceptibly subangulate before the middle, giving the species a distinctive appearance which is generally easily recognizable in both sexes. In the female the last segment is emarginate and the middle of the abdomen, especially toward the base, is distinctly and somewhat aciculate punctate. The male character has been sufficiently given in the table. The last ventral segment is granulate punctate. Within my experience this is the rarest of the *fusca* forms, though widely distributed. I have seen it from Texas, North Carolina, Georgia, District of Columbia, Illinois, Colorado, Maryland, New York, Wisconsin, Nova Scotia, Lake Superior region. Mr. Schwarz thinks it more common about Lake Superior than the other species. In the District of Columbia it is rare, only isolated specimens having been found by the local collectors.

The male ventral character differs from that of the allied species in that there is no perceptible curve to the ridge, which is rather prominent and not at all crested or declivous posteriorly. The genitalia of

the male are but slightly dissimilar, strongly resembling the *fusca* type, yet differing greatly in details, as a reference to the figures will readily show.

The female is rather characteristic, differing from all other of the forms by having the pubic process rather slender and furcate—quite different from the broadly bifid processes of *arcuata*, *insperata*, and *dubia*.

37. L. ulkei Smith.

Form robust, ovate, rufocastaneous, shining. Clypeus slightly emarginate, the border moderately reflexed, surface rather closely punctate, front more coarsely and less closely punctate. Thorax widest at base, arcuatedly narrowed to the apex, margin very indistinctly crenulated, with short ciliae; surface distinctly but rather irregularly and not very closely punctured, with a smooth median line. Elytra more deeply and densely, somewhat confluently, punctured, the costæ evident. Pygidium rather finely and sparsely punctate. Metasternum densely punctured, the hair long and dense. Abdomen shining, sparsely punctate. Claws curved, the tooth median, stronger in the female. Last joint of the maxillary palpi ovate, not impressed.

Length, .85 inch, 21–22^{mm}.

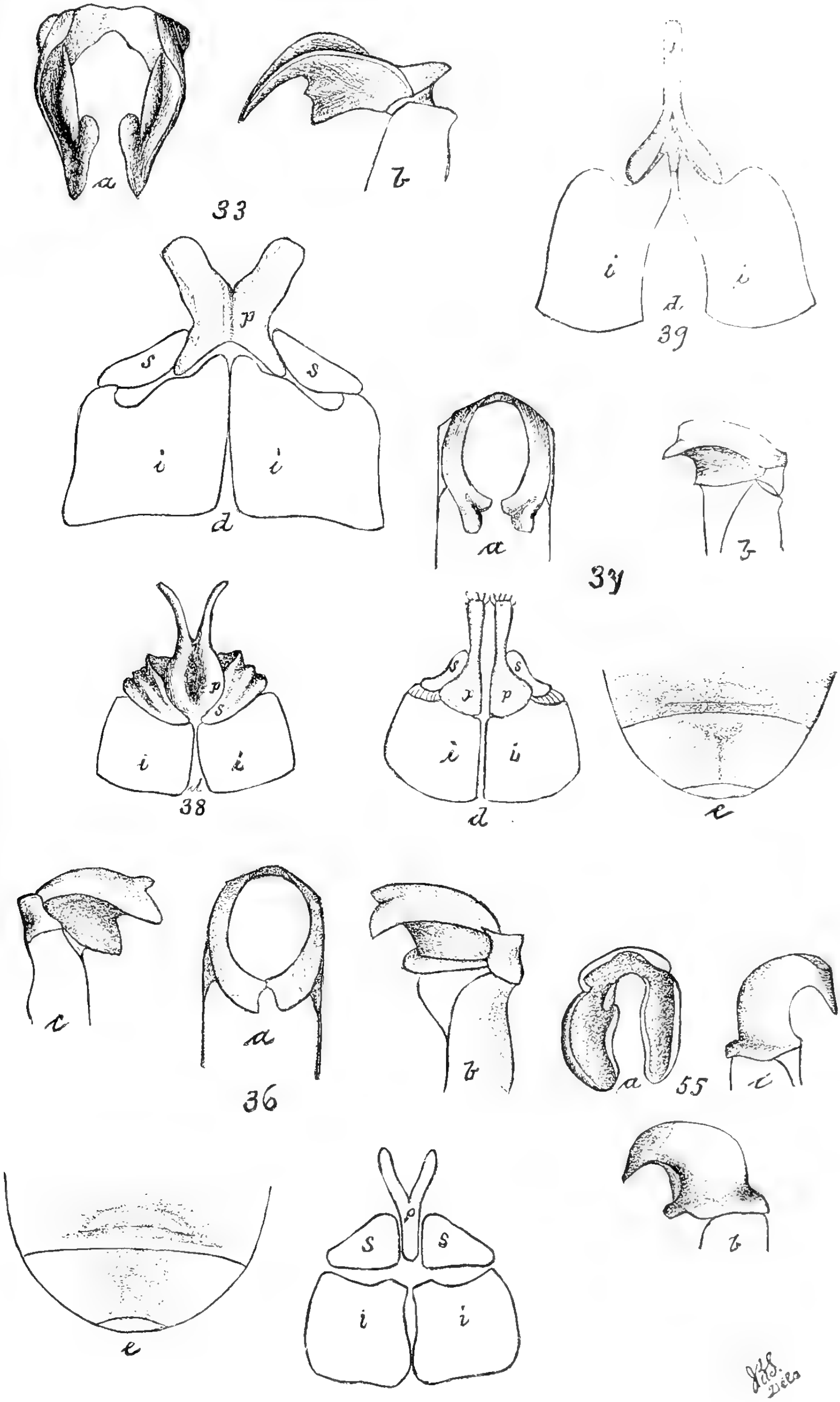
Habitat.—South Carolina, Ulke; Georgia, Ulke; Tennessee, U. S. National Museum; East Florida, Schwarz, 3 ♂, 1 ♀.

Male.—Antennal club as long as the stem, abdomen flattened at middle, penultimate segment with a perfectly straight, feebly elevated ridge, behind which the segment is strongly depressed, making the declivity deep and abrupt without any great elevation of the surface of the ridge. The ridge is close to the margin of the segment, and in the Tennessee specimen almost coincident with it. Last ventral feebly concave. Inner spur of the hind tibiæ two-thirds the length of the outer, and stouter.

Female.—Antennal club small, much shorter than the funiculus. Last ventral segment feebly emarginate at apex. Pygidium more elongate than in the male, more shining, the punctures more sharply impressed.

This species agrees in all essentials and group characters with *fusca*, and with that species it has been confounded. The four specimens before me are very uniform in appearance, and chiefly differ habitally in the paler color and the much more rugose appearance, the punctuation being coarser throughout. The lateral margin of the thorax is also very feebly crenulated, yet not so as to throw the species into another group. The ventral character of the male gives an obvious and safe distinguishing feature for that sex. In the female the somewhat broader, more oval form and the coarser punctuation must suffice.

Mr. Ulke has the male and female; the specimen in the Museum is a male. Another male specimen from eastern Florida, taken by Mr. Ashmead, is in Mr. Schwarz's collection.



SEXUAL CHARACTERS OF LACHNOSTERNA.

33. *L. insperatus*, ♂ and ♀.
36. *L. grandis*, ♂ and ♀.
37. *L. ulkei*, ♂ and ♀.
38. *L. quadrata*, ♀.
39. *L. politula*, ♀.
55. *L. longispina* ♂.

(Explanation of plate on page 524.)

Thus far the species seems southern; whether it ranges further north or west, future collections must show.

The genitalia are closely after the *fusca* type, but they are symmetrical. They approach most nearly perhaps in detail to *grandis*. The female is unique, not only for the group, but for the genus. Here the pubic process is distinctly double, the parts slender, parallel, and quite long. The superior plates are quite reduced, and form lateral supports to the pubic process.

38. **L. quadrata** Smith.

Form oblong, parallel, rather deep brown, shining. Clypeus very feebly emarginate, moderately reflexed, surface coarsely and rather sparsely punctured, front more closely and more deeply punctured. Thorax widest at base, arquately, but not very greatly narrowed to the apex; margin entire, with short ciliæ; surface rather sparsely and irregularly punctate, without an obvious smooth median line. Elytra closely and confluently punctured, the punctures tending to form longitudinal series; costæ obvious but not much elevated. Pygidium sparsely and finely punctate. Abdomen shining, sparsely punctate, the last two segments more coarsely. Claws curved, the tooth strong and median. Last joint of maxillary palpi ovate, not impressed.

Length, .87 inch, 22^{mm}.

Habitat.—Enterprise, Florida, May.

MALE.—Unknown.

FEMALE.—Antennal club small, much shorter than the funiculus. Last ventral segment broadly emarginate at apex.

This species is based upon a single female specimen taken by Mr. Schwarz, and now in his collection. It is evidently related to *fusca*, and agrees with it in all structural details. It is, however, well distinguished by the almost square clypeus, the punctuation of the head and elytra, and by the curiously parallel form.

The genitalia bear out the superficial characters to a remarkable extent, and are unique, though not as peculiar as in *ulkei*. The pubic process is here deeply cleft at tip, but not entirely divided, while the separate tips are divaricate and pointed. The superior plates are rather uniquely corrugated or folded. The discovery of the male would be matter of great interest.

39. **L. politula** Horn.

Not in the Museum collection. Dr. Horn has but a single specimen of uncertain locality, which he kindly allowed me to study. The genitalia very strongly resemble those of *fraterna*, and offer nothing noteworthy.

40. **L. barda** Horn.

Not in the Museum collection.* I owe to Dr. Horn the chance to examine both sexes. The genitalia of the male are among the most pecul-

*A specimen of this species has since been sent me by Mr. Linell for name, and this is now in the Museum collection.

iar in the genus. Not only are they strongly asymmetrical, but the peculiar forms of the claspers are entirely indescribable. The female is also very distinctive, and reference is made to the figures for details of the structures.

41. L. marginalis Lec.

One male and two females in the collection. The male we owe to Mr. Schwarz, the females are from North Carolina (J. B. S.), and Missouri (?). (coll. C. V. R.)

This seems not a common species, and is not easily recognized, though very distinct in genital structure. The claspers in the male are strongly asymmetrical and somewhat peculiar. In the female the structure was somewhat distorted and I figured the parts just as they appear in the specimen. Mr. Ulke has the species from District of Columbia, Georgia, Maryland, New York, Illinois.

42. L. spreta Horn.

Not in our collection. Dr. Horn had but two specimens, both males, and from one of these the drawings are made. The claspers are very decidedly dissimilar, and distinctly peculiar in form. They have also, rather aberrantly, the inner side of tip hairy.

43. L. fraterna Harr.

Of the typical form we have 4 ♂, 4 ♀ from New York, New Jersey, southern Illinois (all from coll. J. B. S.).

Of the variety *cognata* we have 5 ♂, 10 ♀; New York, New Jersey, North Carolina, Louisiana, Nebraska (all from coll. J. B. S.).

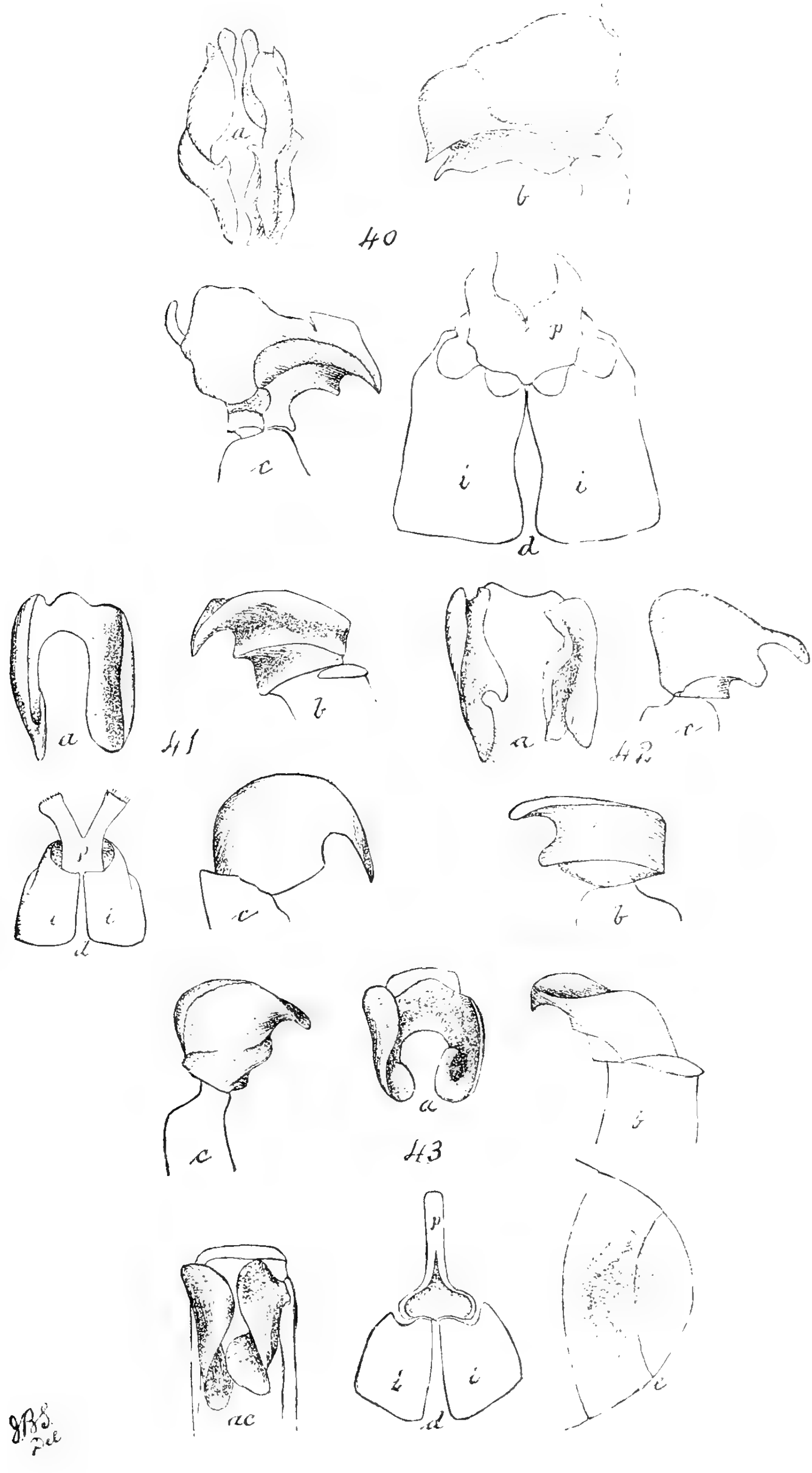
Of the variety *forsteri* we have 1 ♂, 3 ♀, from New York and New Jersey (coll. J. B. S.).

The variety *semi-cribrata* is not represented. Dr. Horn had 2 males, "possibly Georgia."

Our specimens indicate a considerably wider range than that given by Dr. Horn, both to the South and to the West.

In looking over the series in the collection, and in addition the duplicate material, a very strong variability is noted. The size, form, and sculpture differ remarkably, and the polish of the surface is also very inconstant. The male characters also show a decided variation. In some forms Dr. Horn's description applies perfectly, in others there is no distinct elevation, while in the other extreme you may have a perfect arch, always feebly marked at the middle, however. The forms found at Washington differed so strongly that I studied the genitalia of the series carefully with the result that I developed out of specimens referred to the form *forsteri*, a very distinct species.

The genitalia of the male are unusually well developed. The claspers are disproportionately large and very distinctly asymmetrical The figures show two views, the one with the claspers normally open, the other with the claspers closed so far as possible, the specimen having been taken in coitu. The female shows the disappearance of the superior



SEXUAL CHARACTERS OF LACHNOSTERNA.

40. *L. barda*, ♂ and ♀.
41. *L. marginalis*, ♂ and ♀.
42. *L. spreta*, ♂.
43. *L. fraterna*, ♂ and ♀.

(Explanation of plate on pages 524–5.)

plates, and the expansion of the pubic process, which in the next series becomes so prominently marked in some of the species.

44. L. nova Smith.

Oblong; slightly broader behind; chestnut brown, shining. Clypeus moderately emarginate; the border narrowly reflexed; surface densely and coarsely punctured; the front less densely so. Thorax gradually narrowed from base to apex; sides feebly arcuate; the margin distinctly crenate; surface with distinct, irregular punctures; sparse on the disk, where there are irregular, smooth spaces; more dense and equally at the sides. Elytral punctures finer than those of the thorax; much more closely placed; somewhat rugulose; the costæ feeble, but evident. Pygidium sparsely, finely, and indistinctly punctate. Metasternum densely punctured; the hair not long nor dense; shorter in the female. Abdomen sparsely punctate at the sides, the last two segments more coarsely. Claws curved; the tooth strong and median. Last joint of maxillary palpi fusiform, not impressed.

Length .55–.70 inch; 14–18^{mm}.

Habitat.—New York, District of Columbia, North Carolina.

MALE.—Antennal club equal to or slightly longer than the funiculus. Abdomen slightly flattened at middle; penultimate segment with a distinct, arcuate, granulated ridge, behind which the segment is deeply impressed and punctured. Last segment with a cupuliform depression; inner spur of hind tibiæ shorter and stouter than the outer.

FEMALE.—Antennal club shorter than the funiculus. Penultimate ventral segment with a linear impression close to and parallel with the hind margin. Hind tarsi slightly shorter than the male.

This species is not uncommon at Washington, and has been very generally confused with *fraterna*, var. *forsteri*, with which it agrees in all structural features. Apart from the primary differences in the male genitalia, this sex is always easily recognizable by the distinct arcuate ridge of the penultimate segment. The same character is sometimes approached in the var. *forsteri*, but is never so distinct. The thoracic margin in both sexes is more distinctly crenate, though this, is also indicated in some forms of *fraterna*.

There are several specimens of both sexes in the Museum collection from the localities above named. The genitalia of the male differ from those of *fraterna* most remarkably in size as well as in other details. The claspers are not more than one-half as large, much more frail in appearance, and quite differently built. In the female, on the contrary, I can find no differences from *fraterna*. The genitalia are absolutely alike so far as my observations go, and I have examined a considerable number of them.

45. L. infidelis Horn.

The collection contains two female specimens from Georgia (coll. C. V. R.), presenting nothing at all peculiar. To Dr. Horn I owe the male for study.

The claspers of the male genitalia are very lightly and gracefully built, and very strongly dissimilar. The female characters, on the contrary, are small, and not at all well developed. The figures must be referred to for details.

46. L. hornii Smith.

Oblong oval, not broader behind, convex, very deep brown or piceous, shining; clypeus moderately deeply emarginate, rather more acutely in the female; margin narrowly reflexed, rather coarsely, densely punctured, front scarcely less densely punctured. Thorax distinctly narrower in front; sides very obtusely angulate, widest behind the middle, narrowed to base, more obliquely narrowed in front; margin feebly crenate, sparsely ciliate, disc convex, the punctures moderately coarse, variably placed, sometimes closely and equally, sometimes sparsely and irregularly on the disc, leaving smooth spaces, but no smooth median line, a distinct depression of the basal margin externally. Elytral punctures finer, much more dense, somewhat rugulose, costæ evident. Pygidium moderately and somewhat irregularly punctured, less densely so in the female. Metasternum densely punctured, the hair long and dense in the male, short and sparse in the female. Abdomen finely punctate, more dense at the sides, the last two segments much more coarsely and densely. Last joint of maxillary palpi fusiform, not impressed.

Length .75–.85 inch; 19–21^{mm}.

Habitat—Washington, D. C., Tennessee, Virginia, Ohio.

MALE.—Antennal club slightly longer than the funiculus. Penultimate segment with a very strongly elevated, overhanging arcuated crest, occupying nearly the entire length of the segment, behind which there is a deep, transverse punctured impression. In some specimens the crest is divided at the middle, and a longitudinal impression extends forward to the middle of the preceding segment. Last ventral with a quadrate punctured impression, the hind margin with a small deep emargination. Claws arcuate, tooth rather extra median, shorter than the female. The fixed spur is quite short, less than half the length of the outer, and proportionately less stout.

FEMALE.—Antennal club shorter than the funiculus. Pygidium more elongate, the punctures smaller and more sparse. Posterior femora stouter, spurs of hind tibiæ short and stout. Penultimate ventral segment with a strongly impressed line near the hind margin, behind which the segment is depressed. Last ventral segment sinuate at apex, scarcely emarginate. Tarsi not shorter than in the male.

Variations.—In a series of nine specimens no variations are observed. The species is remarkably constant in form and color.

About a dozen specimens of this interesting form were taken at Washington during the present season (1888). None of the local collectors had ever taken it before. As will be seen by the record of captures heading this paper, the specimens were rarely taken. I picked

up one specimen in the morning on a walk in the Smithsonian grounds, badly eaten by ants, and fished another out of a fountain in the White House grounds. Mr. Ulke took two specimens at the electric light. Mr. Schwarz received a single male specimen from the mountains of Tennessee, and Mr. Alwood saw a specimen in a local collection in Virginia. I saw several specimens in Mr. Dury's collection at Cincinnati, Ohio, and the species is probably widely distributed, though rare.

In group characters it would seem at first referable to the *fraterna* section of the *fusca* group, but the large size, very long tarsi, and the marked sexual characters refer it rather with *rugosa* and allies, though the thorax is not as evidently angulated, and the punctures are not nearly so coarse. In the short spur of the male it resembles *infidelis*, while the distinct elytral costæ as well as the male characters make it evidently distinct. I take pleasure in dedicating this strongly marked species to my good friend and mentor, Dr. Horn.

The genital structure is very strongly marked in both sexes. In the male the claspers are very dissimilar and very large. In the female there is a combination of superior plate and pubic process, which is approached but not equaled in other species in this group.

47. **L. biimpressa** Smith.

Oblong, scarcely ovate, pale reddish-brown, shining. Clypeus moderately deeply emarginate; margin narrowly reflexed, densely and rather coarsely punctured, as is also the front. Thorax distinctly narrower in front; sides obtusely angulate, widest at middle, narrowed to base, more obliquely narrowed in front; margin irregular, scarcely crenate, sparsely ciliate; disk convex, the punctures coarse and rather closely placed, a distinct smooth median line, a distinct impression of the basal margin externally, and a distinct foveate impression at each side nearly opposite the angle; elytral punctuation finer, more dense, somewhat rugulose, sutural costa distinct, the others feeble; metasternum closely punctate, with moderately long hair; pygidium rather sparsely, finely, and irregularly punctured; claws arcuate, with a strong median tooth; last joint of maxillary palpi fusiform, not impressed.

Length, .76 inch; 18^{mm}.

Habitat.—Manhattan, Kans., '76.

MALE.—Antennal club nearly as long as the stem. Abdomen flattened at middle, sparsely finely punctuate at the sides, the last two segments more coarsely. Penultimate ventral segment with a rather feebly elevated, strongly arcuated ridge, behind which the segment is deeply impressed and punctured, last segment with a somewhat quadrate depression.

Only a single male is known to me, the source of which I do not know. It seems to be an old specimen, though in good condition, received at the Department of Agriculture, and used in the exhibition series to represent *fusca*. I have placed it in this group, and associated it with *scitula*, though the specimen has very evidently but nine antennal joints

on each side. Yet all the other characters of structure and habitus refer the species here, while it would be otherwise associated with entirely incongruous material. Under the circumstances I regard the nine joints as accidental, and shall expect other specimens to show the typical 10-jointed form.

It is quite possible that the foveate impressions of the thorax are not constant, but they are quite symmetrical in the specimen before me, and are very distinct.

The claspers of the male genitalia are, as usual, distinctly dissimilar, and characteristic. It will be interesting to obtain the female.

48. L. luctuosa Horn.

The collection contains 2 ♂, and 2 ♀ from South Carolina (coll. C. V. R.). The specimens are all very dark, and the female is but slightly, if at all, more ventricose than the male.

The genitalia of both sexes have been examined; the claspers of the male are unsymmetrical as usual, but offer no striking characters. The female structures are more distinctive, showing the rudimentary superior plates, and the bifid pubic process. Mr. Schwarz has taken the species in the District.

49. L. corrosa Lec.

Not in the Museum collection. It is recorded from Illinois and Texas. Mr. Ulke has it from Dakota and Minnesota, and it will probably turn out as widely distributed as most other species.

I owe to Dr. Horn the opportunity of examining the female, and to Mr. Schwarz the male. Both sexes have the genitalia very strongly developed. The claspers of the male are very dissimilar, and of the same type as that of the majority of the species in this group. In the female the superior plates and pubic process are fused, producing a very strongly marked form of a type similar to that of *hornii*, but smaller and less modified.

50. L. scitula Horn.

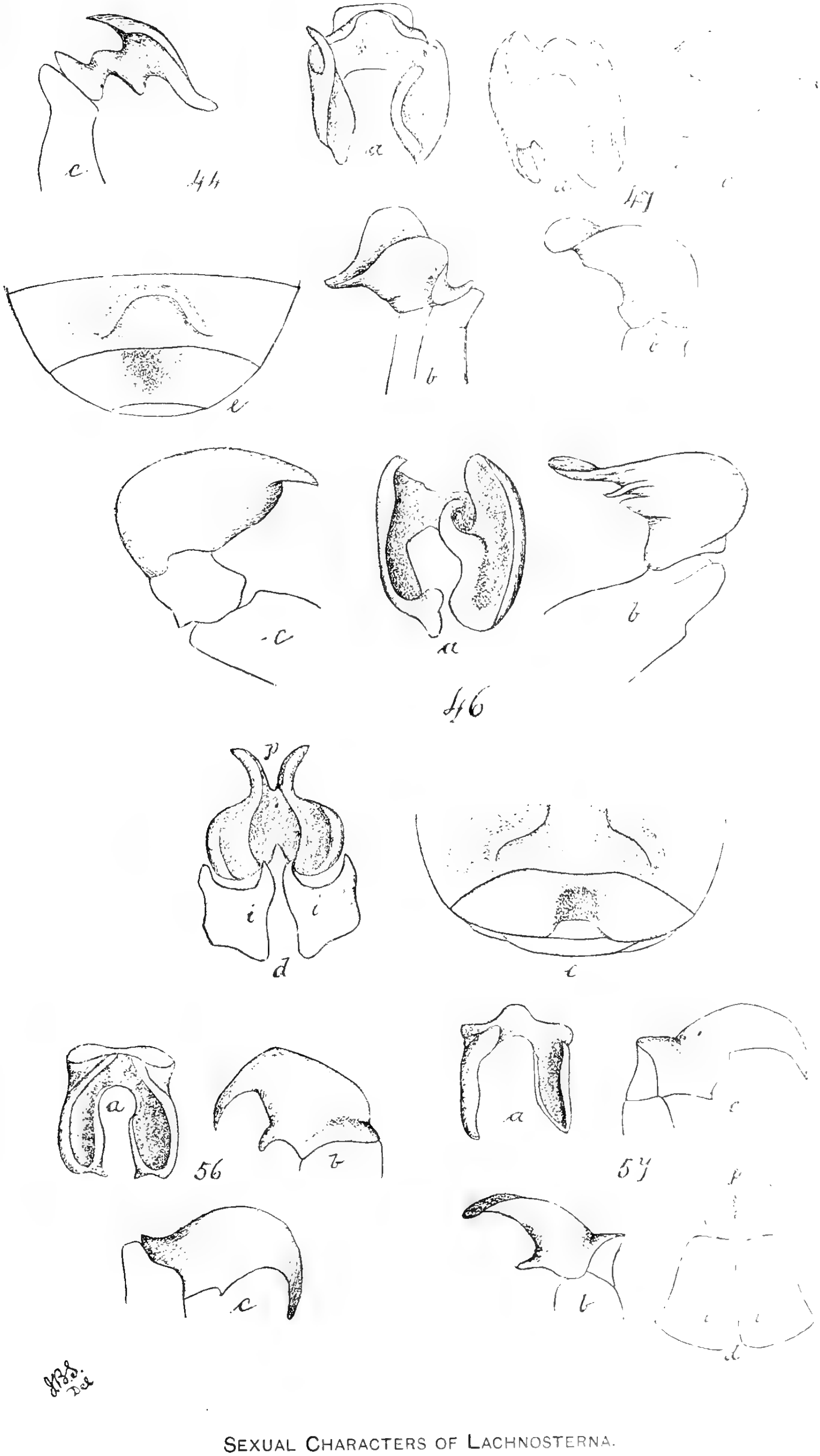
Not in the Museum collection. Dr. Horn has it from Texas, and kindly allowed me to study the species. The male genitalia have the claspers most remarkably modified, and are very different from anything else in the genus. The figures must be left to explain the structures.

51. L. knochii Gyll.

The Museum has 2 ♂ from Kansas (coll. Morrison), and 1 ♀ Texas (coll. J. B. S.).

Dr. Horn gives the *habitat* from Massachusetts to Georgia, and this is therefore a very decided extension of the limit. The species seems rare. In several years collecting around New York City, I found but a single specimen, and that quite early in my experience, for I remember it had a common pin through it. I can not find that others have taken it much more abundantly.

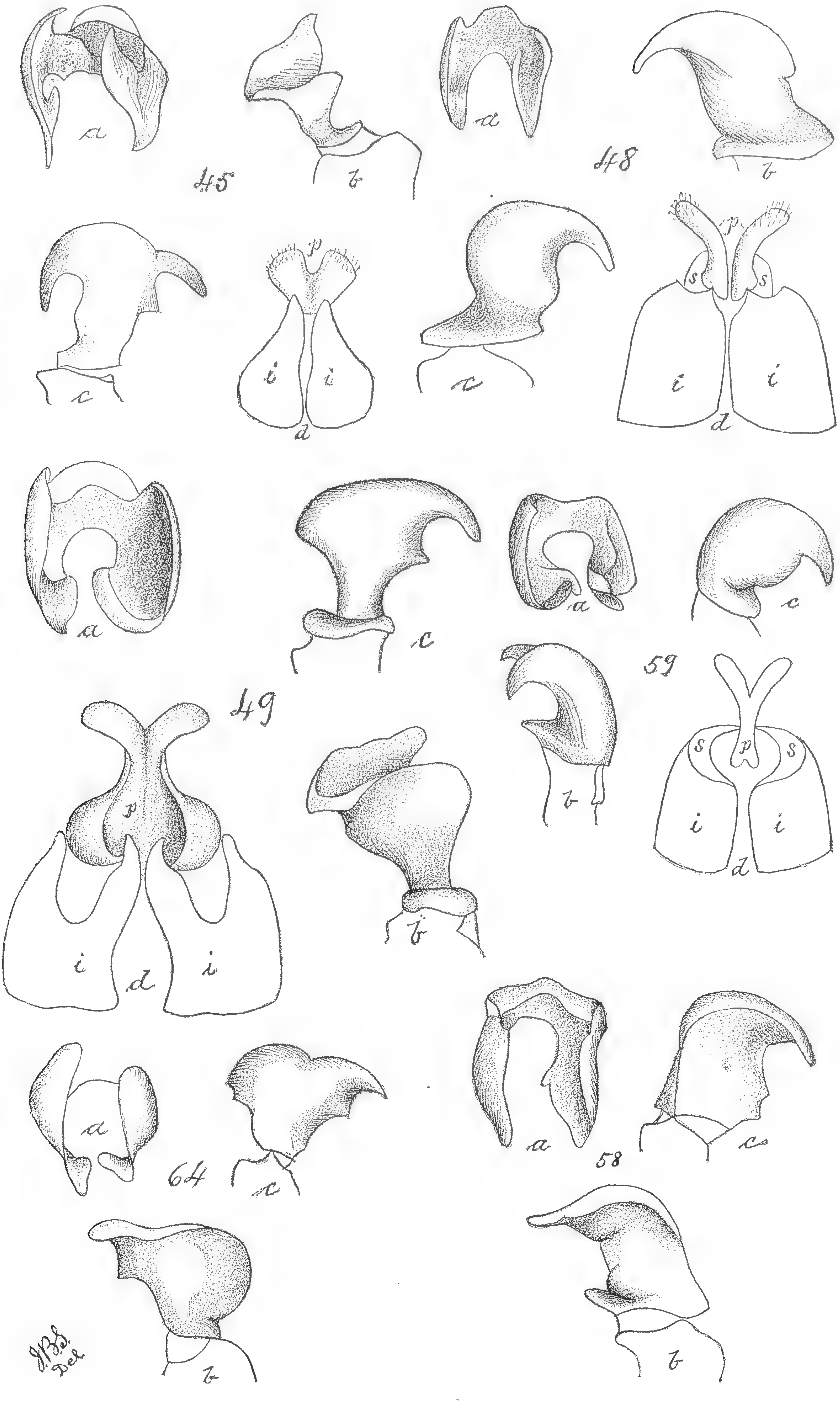
The genitalia are distinctive, yet of very much the same type as the immediately preceding and following species.



SEXUAL CHARACTERS OF LACHNOSTERNA.

44. *L. nova*, ♂ and ♀.
46. *L. hornii*, ♂ and ♀.
47. *L. biimpressa*, ♂.
56. *L. diffinis*. ♂.
57. *L. implicita*, ♂ and ♀.

(Explanation of plate on pages 524-25.)



SEXUAL CHARACTERS OF LACHNOSTERNA.

45. *L. infidelis*, ♂ and ♀.
48. *L. luctuosa*, ♂ and ♀.
49. *L. corrosa*, ♂ and ♀.
58. *L. innominata*, ♂.
59. *L. balia*, ♂ and ♀.
64. *L. delata*, ♂.

(Explanation of plate on pages 524–'5.)

52. **L. profunda** Blanch.

Not in the Museum collection. Dr. Horn says it occurs in Texas, and Mr. Ulke has it also from the District of Columbia, Virginia, and Louisiana, indicating a wide distribution.

I have been able to study the genitalia of both sexes, and the figures will show how similar to, yet distinct from, *knochii* the species is.

53 **L. rugosa** Mels.

Numerous specimens of both sexes are in the collection. New York (coll J. B. S.), 2 ♂; Illinois (coll. Morrison), 5 ♂, 5 ♀; Ohio (coll. C. V. R.), 1 ♂; Kansas (coll. Morrison), 2 ♂; Nebraska (coll. C. V. R., J. B. S.), 4 ♂; Montana (coll. J. B. S.), 1 ♂; Collinsburgh, La., April 12 (coll. C. V. R.), 1 ♂.

No variation not mentioned by Dr. Horn has been observed. The variation in the ventral ridge of the male is marked, but does not change its character. Mr. Schwarz has it, collected at Detroit, Mich., May 30, and at Port Huron, Mich., June 5, nearly two months later than the occurrence of the species in Louisiana. It is the most common of its group and is easily recognized.

The addition of *hornii* and *biimpressa* to this series of species from *infidelis* to *rugosa*, has added material strongly emphasizing the relationship to the *fraterna* group, and yet unique, too, in many characters. In *hornii*, *corrosa*, *knochii*, *profunda*, and *rugosa* we have an association so definitely marked in genital structure of both sexes that concurrence of other characters to form a close association in other respects are naturally expected. There may be eventually a slight re-arrangement of the order of the species here when larger series of some of the forms makes their exact relation more certain. Mr. Schwarz suggests that some of the species in this group may frequent conifers, and this would account for their comparative rarity.

54 **L. hirsuta** Knoch.

There are 7 ♂ and 6 ♀ in the Museum collection. New York (coll. J. B. S.), 5 ♂, 5 ♀; District of Columbia (coll. J. B. S.), 1 ♀; North Carolina (coll. J. B. S.), 2 ♂.

The series offers nothing of special interest. The species is not common, and for some reason seems never to be in handsome condition. Both sexes have been examined and offer distinctive characters. In the male the claspers are unsymmetrical, and introduce a somewhat new type in the line of twisted processes to the inside. The figure shows an upper, back view to better display the process. The female lacks the superior plates; the pubic process, however, very distinct.

The clothing of hair on this species is very variably distinct and usually quite irregularly placed. There is, however, a tendency to a somewhat linear arrangement along the costæ, without forming distinct rows.

 Sept. 3,

55. L. longispina sp. nov.

Oblong, nearly parallel; ferruginous brown, feebly shining; sparsely clothed with yellowish erect hairs, longer and more dense on the thorax, shorter on the elytra, where they form distinct rows on the costæ similar to those of *hirticula*. Head densely and coarsely punctured, with moderately long hair; clypeus emarginate, the border moderately reflexed. Thorax widest at middle, slightly narrowed at base, more at apex, the margin feebly crenate, ciliate; basal margin channelled externally; surface with coarse punctures moderately closely placed, with long erect hairs. Elytral punctures much finer than those of the thorax, less impressed, denser, and somewhat rugulose; the hairs sparser and shorter than on the thorax; the discal costæ not distinct, marked only by the rows of longer hair. Pygidium of male sparsely and not deeply punctate, not hairy. Metasternum densely punctured, the hairs yellow, long, and dense. Claws arcuate; a strong acute median tooth.

Length, .68 inch, 17^{mm}.

Habitat.—South Carolina (Morrison); Grand Ledge, Mich., May 24 (Schwarz).

MALE.—Antennal club a little longer than the stem. Abdomen slightly flattened at middle, the penultimate segment at middle with a transverse, arcuate, rugulose elevation, behind which is a concavity. Last ventral flat. Inner spur of hind tibia fully as long and scarcely stouter than the outer.

FEMALE.—Wanting.

Three specimens of this form, which is perhaps confused with *hirsuta* (with which it agrees in group characters) in collections, are before me, all of them males. The South Carolina specimen is in the U. S. National Museum, the others are in Mr. Schwarz's collection. I believe Mr. Ulke also has a specimen, the locality of which is different from either.

The species is readily known by the almost equally long spurs of the hind tibia and by the distinct lines of hair. The thoracic margin is also very plainly, if feebly, crenate.

The genitalia of the male only have been examined. The claspers are dissimilar, and of quite a different form than in *hirsuta*, despite their similarity in superficial habitus.

56. L. diffinis Blanch=*comans* Horn (Burm).

This species is not in the Museum collection. Dr. Horn had it from Georgia, South Carolina, Florida. Among material determined by me, for Mr. Dury, of Cincinnati, Ohio, was a single male specimen, from which I made the drawings of genitalia. The correction of the synonymy is by Dr. Horn, and is based upon studies made during the doctor's visit to Europe. For a somewhat uncommon species four synonyms are rather a disproportionate share.

In the structure of the claspers of the male there is a very great

similarity to *longispina*, with yet sufficient differences to make the distinction obvious.

57. L. implicita Horn.

There are 2 ♂ and 2 ♀ in the collection given by Mr. Pergande, taken at St. Louis, Mo., in June. It appears a widely distributed species, and locally not uncommon.

The genitalia of both sexes have been examined, and in the male the claspers are dissimilar, as usual. In the female there is a distinct resemblance in the one organ both to pubic process and superior plate, characteristic of *infidelis* and some others. All the specimens seen by me are remarkably constant in appearance.

58. L. innominata Smith.

Oblong oval, convex, chestnut-brown, shining. Clypeus moderately deeply, acutely emarginate, the border moderately reflexed, surface closely rather coarsely punctate, front less densely and more coarsely punctate. Thorax, sides arcuate, narrowing rather regularly toward apex, the margin scarcely irregular, not crenate, with long ciliæ, the punctures small, sparse, and irregularly placed, no median line, a distinct channel along the base externally. Punctures of elytra more coarse and dense than those of thorax, the costæ evident but not prominent. Pygidium sparsely indistinctly punctate. Metasternum punctate, the hair (♂) long and abundant, abdomen indistinctly punctate at the sides, the last two segments more coarsely punctate; claws arcuate, a long acute median tooth, smaller on anterior; last joint of maxillary palpus fusiform, not impressed. Length, 72 inch., 18^{mm}.

Habitat.—Winona, Minn., U. S. National Museum, Acc. 21542.

MALE.—Antennal club as long as the stem. Abdomen flattened and slightly concave at middle. Penultimate segment with a rather feeble semicircular depression, on each side of which is a short oblique tuberosity; last segment transversely concave, almost cupuliform. Inner spur of hind tibia rather more than half the length of the outer, stout and straight.

FEMALE.—Unknown.

This species is known to me in a single male specimen only. It is intermediate in some respects between *implicita* and *balia*, yet abundantly distinct from either. The male characters are more like those of *implicita*, save that the last ventral segment is concave, but the very smooth sparsely punctured thorax is distinctive. The description is after Dr. Horn's description of *implicita*, and the differences between the two are thus readily ascertainable. It is a larger insect than either *implicita* or *balia*.

In the structure of the male genitalia it is closely allied to *implicita*, differing in details, however, if not in type. It would be interesting to know the female, to see whether the resemblance to *implicita* is as distinctly carried out in that sex.

59. L. balia Say.

The collection contains 4 ♂ and 10 ♀. New Jersey, 1 ♂; Massachusetts, 1 ♀ (coll. J. B. S.); New York, 1 ♀, May 22; northern Illinois, 3 ♂ and 8 ♀ (coll. C. V. R. and Morrison).

The males show little or no variation, and are smaller throughout than the females. The latter show on the penultimate ventral segment a more or less evidently impressed line, shorter as it becomes more distinct.

Mr. Ulke has the species collected at Washington and also from Tennessee, thus extending the range of the species southward farther than mentioned by Dr. Horn. Mr. Schwarz has it from Detroit, Mich., July 1.

Both sexes have been studied. The males, as usual, have the claspers dissimilar, and both of them with twisted processes. In the female the pubic process is slender and bifid at the tip. The superior plates are distinct without being large.

60. L. villifrons Lec.

There are 4 ♂ and 6 ♀ in the collection, all from Illinois (coll. C. V. R. and Morrison). There is no obvious variation, except in size, and this variation is not sexual. Mr. Schwarz has the species from Pennington Gap, Va., July 3, and Mr. Ulke has taken it not rarely at the electric light in Washington. It was not among the species captured in the systematic collecting. The two species, *balia* and *villifrons*, are not easily separated, and care is necessary not to confuse them. The difference in shape noted by Dr. Horn I can not make out, and the other differences require tact to discover. In the genitalia the difference is marked in both sexes. The claspers of the male, while appendiculate, are so in an entirely different manner. In the female the superior plates are more fully developed, and the pubic process is short, broad, and stout.

61. L. limula Horn.

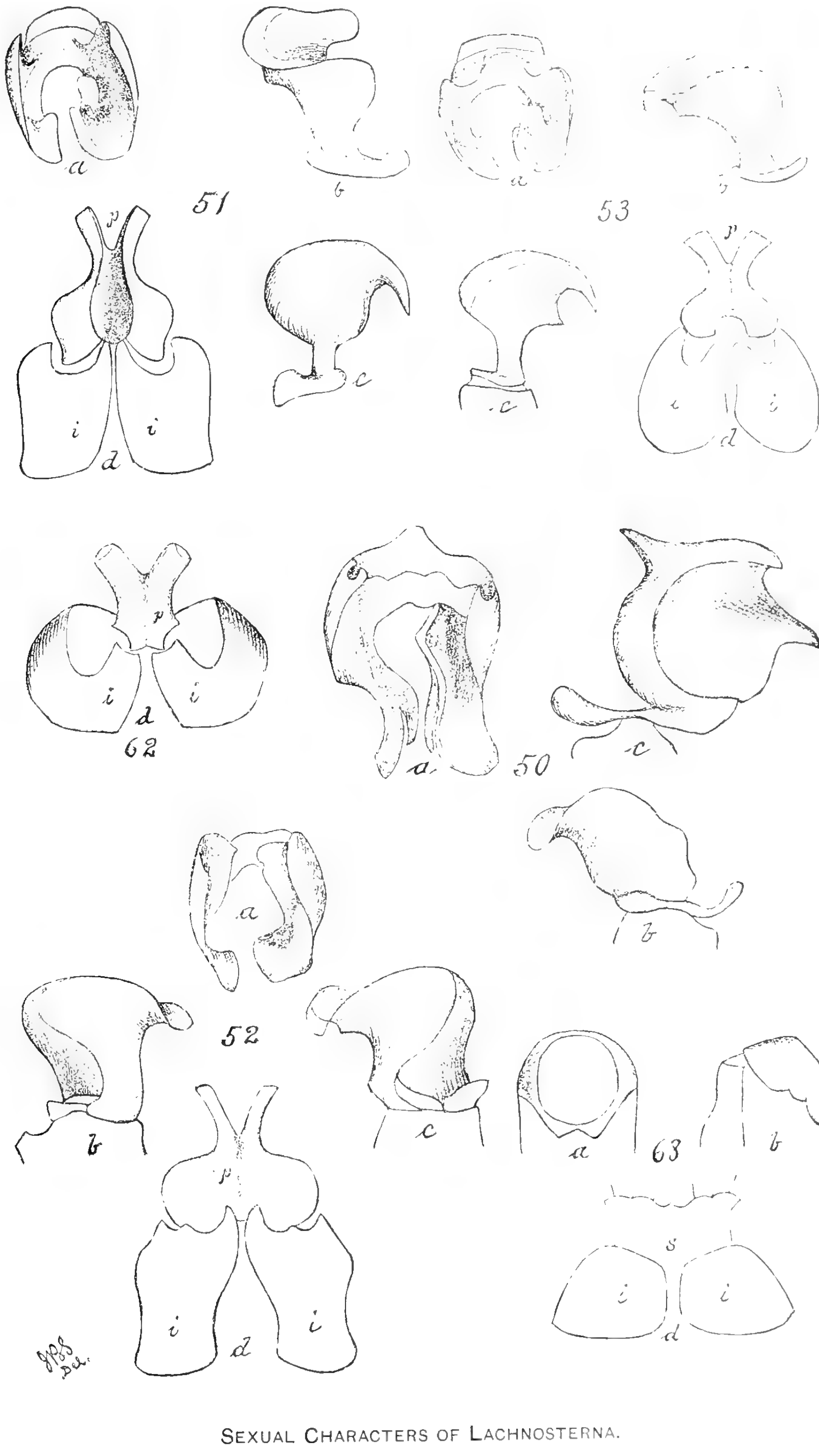
Not in the Museum collection. A widely distributed species west of Illinois. To the kindness of Dr. Horn I owe the opportunity of studying the genitalia of both sexes. The structures of both sexes approach those of *balia*. In the male the claspers are both appendiculate, and quite differently from any other species. In the female the superior plates are well developed, comparing fairly in size with the inferior plates, and the pubic process is long, slender, and narrowly bifid at the tip.

62. L. nitida Lec.

Not in the Museum collection. According to Horn, from Georgia and Pennsylvania. Only a female could be obtained for examination, and this resembles in structure *villifrons* quite closely.

63. L. hirticula Knoch.

Numerous specimens of both sexes. Massachusetts, New York, New Jersey, Pennsylvania, Maryland, District of Columbia, North Carolina,



SEXUAL CHARACTERS OF LACHNOSTERNA.

50. *L. scitula*, ♂.
51. *L. knochii*, ♂ and ♀.
52. *L. profunda*, ♂ and ♀.
53. *L. rugosa*, ♂ and ♀.
62. *L. nitida*, ♀.
63. *L. crenulata*, ♂ and ♀.

(Explanation of plate on pages 524-'5.)

SEXUAL CHARACTERS OF LACHNOSTERNA.

54. *L. hirsuta*, ♂ and ♀.
60. *L. villifrons*, ♂ and ♀.
61. *L. lunula*, ♂ and ♀.
63. *L. hirticula*, ♂ and ♀.
66. *L. æmula*, ♂.
67. *L. arcta*, ♀.
69. *L. albina*, ♀.
70. *L. vetula*, ♂ and ♀.

(Explanation of plate on pages 524-'5.)

Illinois, Missouri, Nebraska, Minnesota. Dates on the specimens range from April 10 (probably under stones) until the middle of July. The introduction will give the dates of the species at Washington.

This insect, wherever it occurs, is almost or quite as abundant as *fusca* or its local representative. The species is remarkably constant in the character of the elytral vestiture, but remarkably variable in other respects. A series obtained from Illinois were so much larger and so much more coarsely sculptured, that I at once suspected a new form allied to *rugosa*; so strong is this impression at first sight that a rubbed specimen would be unhesitatingly placed with *rugosa*. The ventral characters are, as usual, variable in the distinctness of the depression and ridge of the male. The majority agree well with Dr. Horn's general expression, but quite a fair proportion have the transverse ridge strongly marked. In the female the feature pointed out in several other species exists, viz, a vague transverse line on the penultimate segment, gradually developing until there is a distinct ridge; always a short one, however.

In the genital structure the relationship to the *rugosa* group is emphasized in both sexes, though perhaps not more so than to *ilicis*. It would almost seem as if groups X and XI should exchange places.

64. L. delata Horn.

Not in the Museum collection. But two males, from east Kentucky, were known to Dr. Horn, and of these he allowed me to study one. On a considerably reduced scale the claspers of the male resemble those of *ilicis*.

65. L. ilicis Knoch.

Numerous specimens of both sexes. New York, New Jersey (coll. J. B. S.); Pennsylvania, North Carolina (coll. Morrison); Georgia (coll. J. B. S); northern Illinois, central Missouri (coll. C. V. R.); Kansas (coll. C. V. R., J. B. S.); Iowa (coll. J. B. S.).

Included in the above are the localities for *ciliata* Lec., which I can not believe distinct from *ilicis*. This species ranges to Kansas—much farther west than given by Dr. Horn, and one of these specimens puzzled me not a little before I would say it were either *ilicis* or *ciliata*. From Pennsylvania we have 3 ♂ and 1 ♀, apparently collected at the same time. Of these, 2 ♂ are good *ilicis*, while 1 ♂ and 1 ♀ are perfect *ciliata*. Of the specimens collected by myself in New York, all were taken near the entrance of Prospect Park, Brooklyn. Of these, some are decidedly pruinose, and with scarcely perceptible pubescence, while others are decidedly pubescent, with more or less upright hair intermixed, in some specimens forming the lines along the elytral costæ, typical of *ciliata*. The characters of color and punctuation are all evanescent, and I can not find any evident difference in the crenation of the thoracic margin. In the ventral characters of the male the differences are of extent rather than character, and not constant. The female *ilicis*

is said to have the pygidium longer than wide. In our most typical specimen careful measurement shows that it is about one-fifth wider than long, and about the same as in *ciliata*. Finally the sexual structures are identical throughout the entire series, and, as has been hinted, partake very decidedly of the *rugosa* type—the female with the developed pubic process, the males with very strongly dissimilar claspers.

66. **L. æmula** Horn.

Two male specimens from Florida, given by Mr. Schwarz, are in the Museum collection. Mr. Schwarz collected the specimens at Haulover, Fla., March 11–13, and states that they fly shortly before sunrise, instead of at dusk and early evening, as do most of the other species. The impression on the last ventral segment of the male is very variably distinct, sometimes very deep, with a marked conic elevation each side, sometimes so faint and vague, that it is almost impossible to say whether the specimen is a male or a female.

With this species begins again the series of forms in which the genital organs vary in the direction of simplicity. The claspers of the male are symmetrical, and are united in front. The female was studied, but in some way the preparation was mislaid and no drawing made. My recollection is that it resembled rather closely the *arcta* type.

67. **L. arcta** Horn.

Not in the Museum collection. The female only is known, and I owe to Dr. Horn an opportunity to study that sex. The superior plates are distinct, but are united medially, and form a pseudo pubic process well studded with short hair.

68. **L. crenulata** Froehl.

Numerous specimens, male and female, are in the collection. New York, New Jersey, 13 ♂, 6 ♀ (coll. J. B. S.); Texas (coll. C. V. R., J. B. S.), 2 ♂, 1 ♀; Iowa (coll. C. V. R.), 1 ♂; central Missouri, May, 3 ♂; northern Illinois, 2 ♂; Alabama, May 10, 3 ♀; Tennessee, 1 ♀ (all coll. C. V. R.). Mr. Ulke also has it from Florida, Nebraska, and Dakota. For dates of captures in the District, see the introductory remarks. Mr. Schwarz collected it in Kentucky April 10; in Michigan (Lake St. Clair, Detroit, Port Huron) in June. These localities indicate a wider distribution than that given by Dr. Horn, and it has probably as wide a range as any of the species. I have collected the species myself on blackberry early in the evening, taking them by the dozens. Curiously enough, during the collecting at Washington not a single specimen was seen on that plant, though I returned again and again to the search.

In the series before me the males average larger throughout than the females, though they are not so robust. As a rule, the females are darker, nearly black in some cases; the hair is also longer and coarser than the males, and the specimens thus show considerable variation. In some forms the legs and ground color of elytra are black, and this form looked distinct at first, but I could not discover any differences.

The sexual characters are still more simple than the preceding, strikingly resembling those of *lanceolata* in the male. The female has the superior plates united along the median line, and forms the usual substitute for the pubic process.

69. **L. albina** Burm.

Not in the Museum collection. From a borrowed specimen I studied the female, in which the superior plates are distinct and not united.

70. **L. vetula** Horn.

We have one female specimen (coll. J. B. S.) from New Mexico. It is a striking species, quite unlike anything else in our fauna or that is known to me. I have been able to study the male in a lot of material obtained for determination. Dr. Horn says of the female: "Claw, tooth long and median." In the specimen before me the tooth is moderately long but decidedly intra-median, especially on the fore tarsi. The claspers of the male are here symmetrical and united in front. The female has the superior plates well developed and unusually prominent. Mr. Ulke has the species from Arizona.

71. **L. rubiginosa** Lec.

There are 17 ♂ and 2 ♀ in the Museum collection, all from Texas (coll. C. V. R., J. B. S.).

The specimens show no variation, except in size. The series of longer hairs along the elytral costæ in the female are very distinct and recognizable, even in some of the males, though never so prominently. One specimen bears date April 20.

The sexual characters of the male become still more simple, as a reference to the figure (71) will show. In the female the superior plates are very short and united along the median line.

72. **L. parvidens** Lec.

There are four males in the Museum collection: Florida (coll. J. B. S.), 1 ♂; Georgia (coll. C. V. R., J. B. S.), 3 ♂. Mr. Ulke has it also from Virginia and the District of Columbia. Mr. Schwarz has it from Tampa, Fla., April 5–8.

No variation appears in our specimens. The male characters differ very distinctly from the forms immediately preceding, the claspers being distinct, rather characteristic in form, and free in front. The female structures, on the other hand, are reduced to a minimum, only the inferior plates remaining distinct.

73. **L. submucida** Lec.

There are 33 ♂ and 22 ♀ in the Museum collection, all from Texas (coll. C. V. R., J. B. S.). Except a slight variation in size there is absolutely no variation. Dates are on two specimens—June 6 and June 10.

The sexual characters are again more marked in this species. In the male the clasper, while symmetrical, is distinctive, and quite strongly modified. In the female both plates are very distinct and well characterized. There is no pubic process.

74. L. glabricula Lec.

There are ten males in the Museum collection from Texas and Kansas (coll. C. V. R.).

The female of this species was unknown to Dr. Horn, and I have not found it in any collection examined by me. The claspers of the male genitalia are quite characteristic and strongly modified, yet symmetrical.

75. L. fucata Horn.

Not in the Museum collection. I owe the chance of studying the male to Dr. Horn. The claspers of the male are symmetrical and quite distinctive. I have not been able to obtain the female.

76. L. exorata Horn.

Not in the Museum collection. The specimens known are from Texas, and species is probably local. To Dr. Horn I owe the chance of studying the male, which is quite characteristic in sexual structure. The claspers are symmetrical, free in front, and with a distinctive process anteriorily.

77. L. ignava Horn.

There are 3 ♂ and 1 ♀ in the Museum collection, all from Texas (coll. C. V. R.).

The specimens were collected by Belfrage, and the range of variation in size is greater than that given by Dr. Horn. Our smallest male is .56 inch, our only female .67 inch. Otherwise the specimens agree perfectly, and show no variation at all.

The male only has been studied, for some reason which I do not now remember. The male organs are characteristic from the tendency, here first strongly marked, to the oblique lengthening of the apex. The claspers are symmetrical, little modified, and absolutely immobile.

L. longicornis Blanch.

This must be dropped from our lists. Dr. Horn has seen the type, and says that it is not North American.

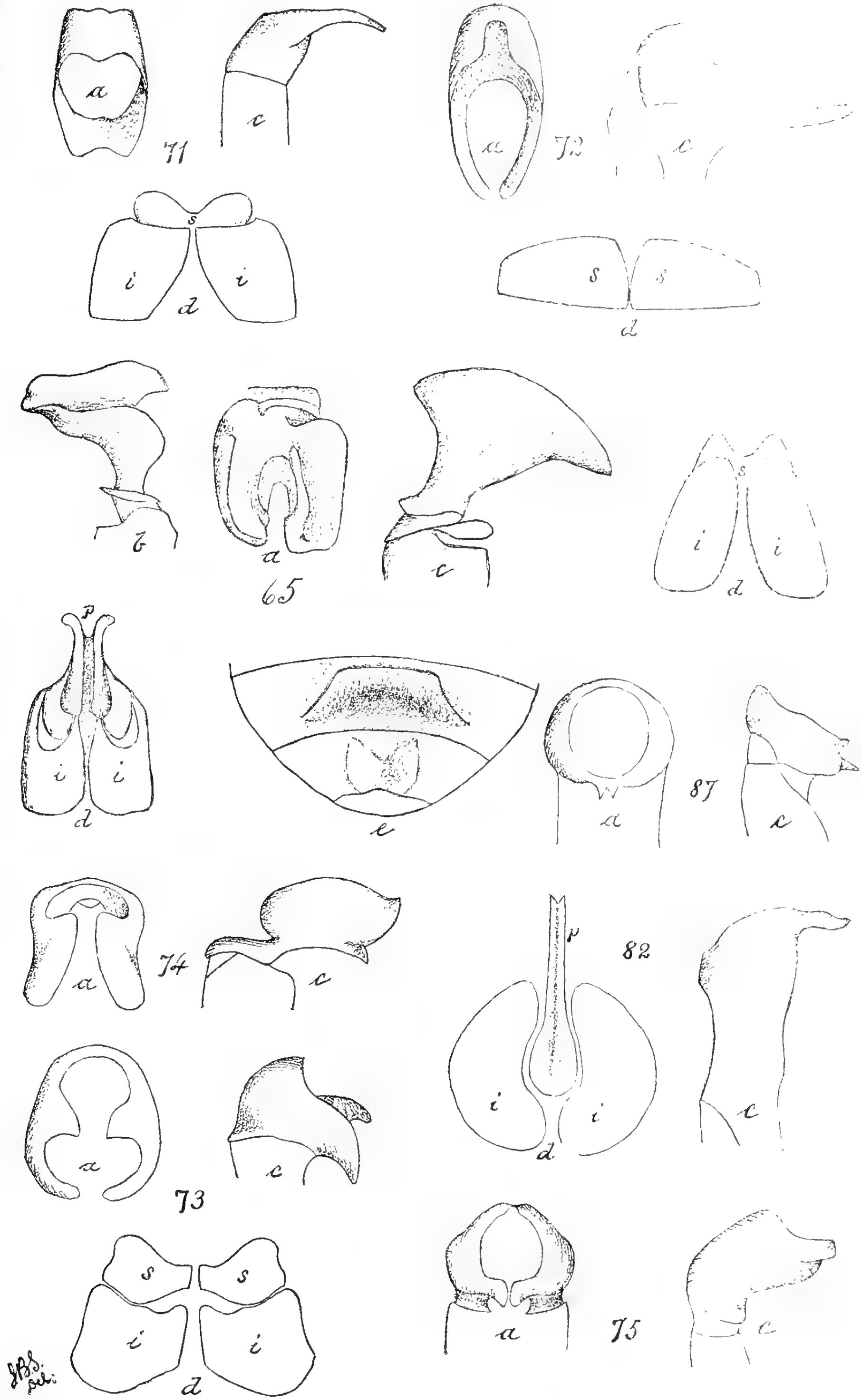
78. L. quercus Knoch.

There are four males in the collection—North Carolina, Louisiana, Florida (coll. J. B. S. and Morrison). The range of the species is thus somewhat extended southward.

The species is not at all a common one, and is not often found in miscellaneous collections. The male only has been studied. It has, like the other species with which it is allied, symmetrical claspers, not united anteriorly, and sufficiently modified to be distinctive.

79. L. inepta Horn.

Two males from North Carolina (coll. J. B. S.) are in the collection. The locality is new, Dr. Horn's specimens being from Ohio. One of our specimens has the ventral characters very strongly marked, and precisely as described; the other is so much weaker as to scarcely differ from a specimen of *quercus*, in which the depression is well marked. The shining surface is really all the difference I am able to make out



SEXUAL CHARACTERS OF LACHNOSTERNA.

65. *L. ilicis*, ♂ and ♀.
71. *L. rubiginosa*, ♂ and ♀.
72. *L. parvidens*, ♂ and ♀.
73. *L. submucida*, ♂ and ♀.
74. *L. glabricula*, ♂.
75. *L. fucata*, ♂.
82. *L. boops*, ♂ and ♀.
87. *L. lenis*, ♂.

(Explanation of plate on pages 524-5.)

between the few specimens of *inepta* and *quercus*. The female is as yet unknown.

The genital structure of the male is very distinctive, and more nearly allied to *ignava* than *quercus*. The claspers are immobile, slender and curved, not united in front.

80. L. affabilis Horn.

Wanting in the Museum collection; occurs in Kansas, whence Dr. Horn had two males. From one of these the drawings were made. The claspers are of a somewhat different type from those of the previous species, while still symmetrical and free in front It approaches nearer in type to *glabricula*.

81. L. clypeata Horn.

Male and female from Mr. Schwarz. Enterprise, Fla., May 8–29.

Both sexes of this have been examined. The claspers of the male have a considerable resemblance, seen from the front, to *affabilis*. They are, however, quite differently set on the telum, and present a very distinctive lateral view. The female is peculiar. The pubic process is stout, quite long, irregularly subulate and acutely notched at the tip. The superior plates are wanting.

82. L. boops Horn.

Male and female from Mr. Schwarz are in the collection. Crescent City and Indian River, Fla. The male organs have a strong resemblance to those of *inepta*, yet differing decidedly in detail. The length of the claspers or their practical continuity with the telum are unique features. The female organs are equally peculiar, yet perhaps merely a development of the *clypeata* type. The form of the superior plates is entirely unique, as is also their relative situation to the pubic process.

83. L. ecostata Horn.

Not in the Museum collection. I owe to Dr. Horn the privilege of examining the male. The genital structure is here again quite unique. The form of the claspers, and particularly their peculiar contiguity, are distinctive. The female must be very interesting. It may be a still more exaggerated form of the type seen in *boops*.

84. L. crinita Burm.

Seventeen males are in the collection, all from Texas (coll. C. V. R., J. B. S.).

The species is very constant; little variation noted, except in size. The greatest factor as to variability is in the length of the antennal club of the male. Always very long, the tendency is to exaggeration, becoming sometimes fully three times as long as the funiculus.

The genitalia of the male are figured, and, like all in the present group, the claspers are symmetrical and united in front. In all the species the structure is very similar, small matters of detail only emphasizing the differences between them. The structures are small, and

rather imperfectly chitinized, yet not membranous. In the females of all the species the corneous characters seem to have disappeared. There is nothing visible. In the common *tristis* I have closely examined many specimens, both fresh and dried, without finding any definite structures. All the species in this group are closely related, *lenis* being perhaps most distinct, and they illustrate the extreme of simplicity found in this genus, so far as sexual characters are concerned, illustrating also the extreme of development in antennal structure.

85. L. antennata Smith.

This species is intermediate between *tristis* and *crinita*, while evidently distinct from both. It has the size, vestiture, and general habitus of *tristis*, but the smooth, shining surface of *crinita*. The antennæ have the club distinctly longer than the stem, and much longer than in *tristis*, without attaining the abnormal development of *crinita*. The female is recognizable by the shining surface, associated with the vestiture of *tristis*.

Size of *tristis*.

Habitat.—Texas, Belfrage.

The Museum collection contains a long series of males, and but a single female. There is no variation whatever, except a very slight one in size. The sexual ventral characters are as in *tristis*. I have seen other specimens than these in the Museum collection, and all are from Texas. It is probably common.

The remarks under *crinita* will apply as well to this species, so far as the genitalia are concerned.

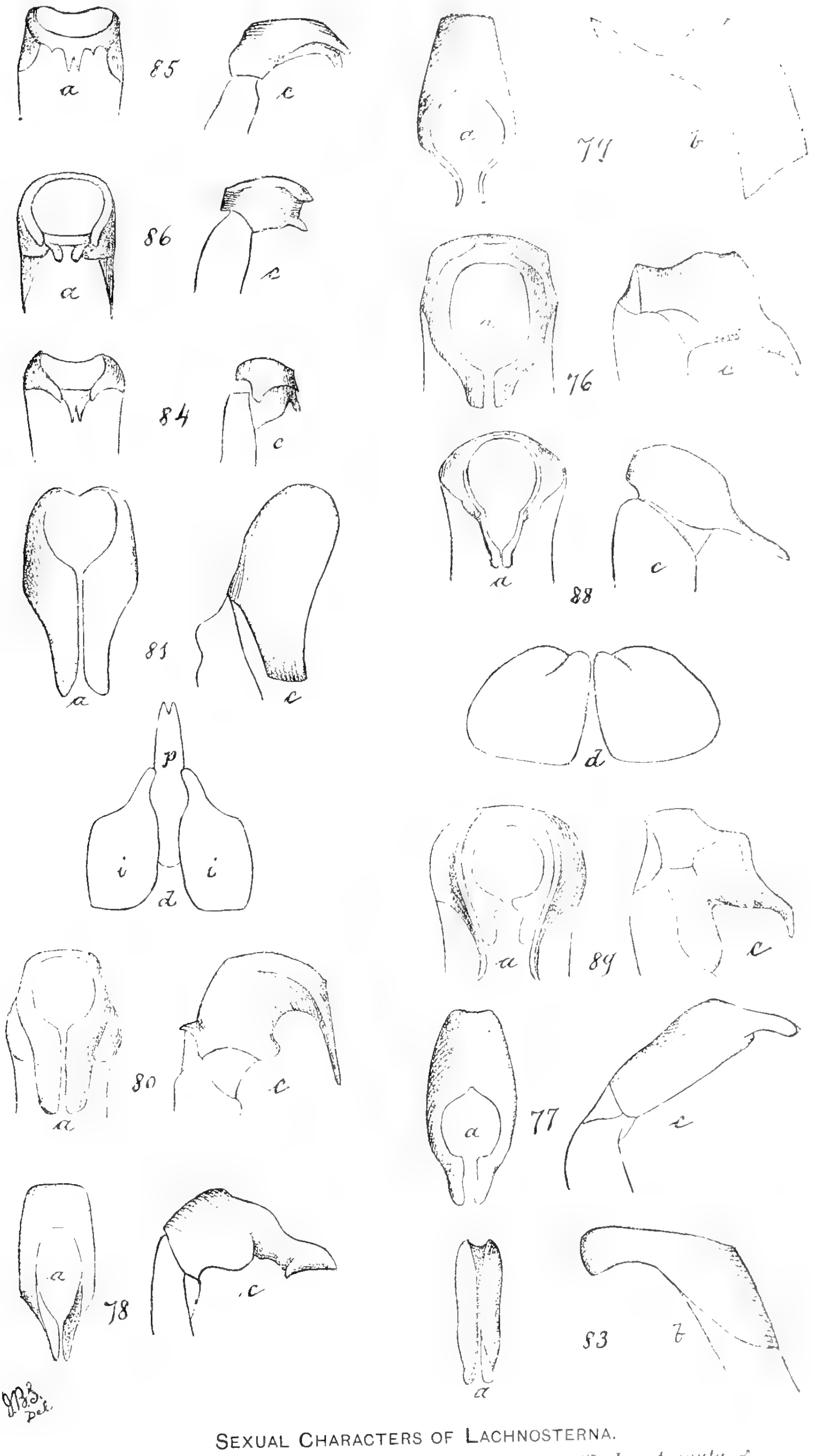
86. L. tristis Fabr.

The Museum series contains 47 ♂, 54 ♀ (all from coll. C. V. R. and J. B. S.). The localities are New York, New Jersey, Pennsylvania, District of Columbia, North Carolina, South Carolina, New Hampshire, Kansas, Wisconsin, central Missouri, Iowa, central Illinois, Texas. The dates on the specimens range from April 20 to June 23. The former from central Missouri, the latter from New Hampshire. For dates of occurrence in the District of Columbia see introductory remarks.

In this species there is little variation, except in size, and this ranges from .35–.60 inch, the smallest specimens being from Kansas. The ventral characters are not strongly marked, and the variations pointed out by Dr. Horn are distinctly seen in the series. The smoother, more shining surface in southern and western species is conspicuous, as is also the uniformly smaller size. In addition, the pubescence of elytra becomes decidedly shorter and more sparse, and the club of antenna is somewhat longer. In neither direction, however, does the species interfere with *antennata*. Nothing more need be said about the genitalia.

87. L. lenis Horn.

We have 3 ♂ from Arizona (coll. C. V. R.), all as nearly alike as possible. Nothing need be said about the male genitalia, save that they



SEXUAL CHARACTERS OF LACHNOSTERNA.

76. *L. exorata*, ♂.
77. *L. ignava*, ♂.
78. *L. quercus*, ♂.
79. *L. inepta*, ♂.
80. *L. affabilis*, ♂.
81. *L. clypeata*, ♂ and ♀.
83. *L. ecostata*, ♂.
84. *L. crinita*, ♂.
85. *L. antennata*, ♂.
86. *L. tristis*, ♂.
88. *L. heterodoxa*, ♂ and ♀.
89. *L. fusa*, ♂.

(Explanation of plate on pages 521–'5.)

are of the same type as the rest of the group. The female, however, has the genital plates distinct, somewhat resembling *arcta*.

88. L. heterodoxa Horn.

Not in the Museum collection; it was collected in Arizona. Dr. Horn kindly gave me both sexes for study. The sexual structures here show a very decidedly greater development than in the *tristis* group, in both sexes. The claspers of the male are symmetrical, rather slender, and curved, barely united in front. In the female there is a peculiar development of the inferior plates, which is unique. There is no trace of superior plate or pubic process.

89. L. tusa Horn.

Not in the Museum collection. Dr. Horn kindly allowed me to study a specimen from his collection. The genitalia of the male are very distinctive and represent quite a peculiar type, much higher than the position of the species in the series, or indeed its appearance, would indicate. The female has not been studied.

90. L. maculicollis Lec.

Not in the Museum collection. The species is from lower California. No dissections were made of this species, as it looked too frail to risk the softening necessary, and material was scarce.

91. L. nitidula Lec.

Not in the Museum collection. Also from lower California, and not studied for the same reason given for the preceding.

As the result of the preceding studies the number of species is increased from 81 to 91. Two species of Dr. Horn's list are dropped—*ciliata*, referred as a synonym of *ilicis*, and *longicornis*, which turns out not North American. Of by far the greatest number of species both sexes are figured—of nearly all one sex is represented. Altogether there are nearly 300 figures. The task has not been a light one nor has the work been hastily done. At present writing eleven months have elapsed since the first specimens were taken for the season of 1888, and much more than a year since I made the notes on the Museum collection which I have incorporated here. The paper was not begun nor intended as a contribution to systematic entomology. Dr. Horn's arrangement is unexceptionable, and the aim of his paper—the knowledge of the species—was fully accomplished. My own work tends rather to call attention to a set of structures that must eventually be studied more closely by the systematist. They render the identification of a species both certain and easy, and will often solve doubts as to specific identity or distinctness. The few species which I have described have not been sought to gratify a desire to describe, but simply to complete the work. Further collections in new localities will undoubtedly increase the number of species, and of course also our knowledge of their habits. As it stands at present *we do not know positively the larva of a single species of Lachnosterna*. It ought not to be difficult

to find those of the more common species. Nor do we know how long they remain in the larva state—more than one year certainly, possibly three. Will not our coleopterological friends try and work out some of these problems? There are plenty of them.

EXPLANATION OF PLATES XLVIII–LX.

The figures are consecutively numbered, but not regularly arranged on the plates. In each case the number of the figure corresponds to the number of the species in the text, and each group of figures refers to the same species. The lettered figures throughout have the same meaning: *a*, claspers of male from front or above; *b*, right clasper; *c*, left clasper; *d*, female organs. These are always sub-lettered as follows: *i*, inferior plates; *s*, superior plates; *p*, pubic process. Other special letterings are explained as they occur. Missing numbers represent the numbers of species not studied.

PLATE XLVIII.

1. L. lanceolata, Say, ♂ and ♀.
2. L. cribrosa, Lec., ♂ and ♀.
4. L. farcta, Lec., ♂ and ♀.
5. L. torta, Lec., ♂ and ♀.
6. L. hamata, Horn, ♂.
7. L. latifrons, Lec., ♂ and ♀.
8. L. generosa, Horn, ♂.
9. L. prætermissa, Horn, ♂.
10. L. prununculina, Burm., ♂ and ♀.

(9 species in 22 figures.)

PLATE XLIX.

11. L. glaberrima, Blanch., ♂ and ♀.
    a. Claspers of males from above.
    aa. Same from front.
12. L. ephilida, Say, ♂ and ♀.
13. L. longitarsus, Say, ♂.
14. L. clemens, Horn, ♂.
15. L. dispar, Burm., ♂.
16. L. gracilis, Burm., ♂ and ♀.
17. L. gibbosa, Burm., ♂ and ♀.
    e. Ventral characters of ♂.
18. L. hirtiventris, Horn., ♂.

(8 species in 22 figures)

PLATE L.

19. L. congrua, Lec., ♂ and ♀.
20. L. postrema, Horn., ♂.
21. L. affinis, Lec., ♂ and ♀.
22. L. prunina, Lec., ♂ and ♀.
24. L. crassisima, Blanch., ♂ and ♀.
25. L. subpruinosa, Casey, ♂.
26. L. errans, Lec., ♂.

(7 species in 20 figures.)

PLATE LI.

27. L. inversa, Horn, ♂ and ♀.
    e. Ventral characters of ♂.
28. L. bipartita, Horn, ♂ and ♀.
29. L. micans, Knoch, ♂ and ♀.
30. L. definita, Smith, ♂.
31. L. vehemens, Horn, ♂ and ♀.

(5 species in 19 figures.)

PLATE LII.

32. L. arcuata, Smith, ♂ and ♀.
    e. Ventral characters of ♂.
34. L. dubia, Smith, ♂ and ♀.
    e. Ventral characters of ♂.
35. L. fusca, Fröhl, ♂ and ♀.
    e. Ventral characters of ♂

(3 species in 15 figures.)

PLATE LIII.

33. L. insperatus, Smith, ♂ and ♀.
36. L. grandis, Smith, ♂ and ♀.
    e. Ventral characters of ♂.
37. L. ulkei, Smith, ♂ and ♀.
    e. Ventral characters of ♂.
38. L. quadrata, Smith, ♀.
39. L. politula, Horn, ♀.
55. L. longispina Smith, ♂.

(6 species in 17 figures.)

PLATE LIV.

40. L. barda, Horn, ♂ and ♀.
41. L. marginalis, Lec., ♂ and ♀.

PLATE LIV—Continued.

42. L. spreta, Horn, ♂.
43. L. fraterna, Harr., ♂ and ♀.
    ac. Claspers of ♂, closed.
    e. Ventral characters of ♂.

(4 species in 17 figures.)

PLATE LV.

44. L. nova, Smith, ♂ and ♀.
    e. Ventral characters of ♂.
46. L. hornii, Smith, ♂ and ♀.
    e. Ventral character of ♂.
47. L. biimpressa, Smith, ♂.
56. L. diffinis, Blanch., ♂.
57. L. implicita, Horn, ♂ and ♀.

(5 species in 19 figures.)

PLATE LVI.

45. L. infidelis, Horn, ♂ and ♀.
48. L. luctuosa, Horn, ♂ and ♀.
49. L. corrosa, Lec., ♂ and ♀.
58. L. innominata, Smith, ♂.
59. L. balia, Say, ♂ and ♀.
64. L. delata, Horn, ♂.

(6 species in 22 figures.)

PLATE LVII.

50. L. scitula, Horn, ♂.
51. L. knochii, Gyll., ♂ and ♀.
52. L. profunda, Blanch., ♂ and ♀.
53. L. rugosa, Mels., ♂ and ♀.
62. L. nitida, Lec., ♀.
68. L. crenulata, Fröhl. ♂ and ♀.

(6 species in 19 figures.)

PLATE LVIII.

54. L. hirsuta, Knoch, ♂ and ♀.
60. L. villifrons, Lec., ♂ and ♀.
61. L. limula, Horn, ♂ and ♀.
63. L. hirticula, Knoch, ♂ and ♀.
66. L. æmula, Horn, ♂.
67. L. arcta, Horn, ♀.
69. L. albina, Burm., ♀.
70. L. vetula, Horn, ♂ and ♀.

(8 species in 24 figures.)

PLATE LIX.

65. L. ilicis, Knoch, ♂ and ♀.
    e. Ventral characters of ♂.
71. L. rubiginosa, Lec., ♂ and ♀.
72. L. parvidens, Lec., ♂ and ♀.
73. L. submucida, Lec., ♂ and ♀.
74. L. glabricula, Lec., ♂.
75. L. fucata, Horn, ♂.
82. L. boops, Horn, ♂ and ♀.
87. L. lenis, Horn, ♂.

(8 species in 23 figures.)

PLATE LX.

76. L. exorata, Horn, ♂.
77. L. ignava, Horn, ♂.
78. L. quercus, Knoch, ♂.
79. L. inepta, Horn, ♂.
80. L. affabilis, Horn, ♂.
81. L. clypeata, Horn, ♂ and ♀.
83. L. ecostata, Horn, ♂.
84. L. crinita, Burm., ♂.
85. L. antennata, Smith, ♂.
86. L. tristis, Fabr. ♂.
88. L. heterodoxa, Horn, ♂ and ♀.
89. L. tusa, Horn, ♂.

(12 species in 26 figures.)

(In all, 87 species; in 265 figures.)

DESCRIPTION OF COREGONUS PUSILLUS, A NEW SPECIES OF WHITEFISH FROM ALASKA.

BY TARLETON H. BEAN.

Coregonus merki, var. BEAN.
Proc. U. S. Nat. Mus., Vol. IV., 1881, p. 256; Cat. Fish. U. S. Nat. Mus. Fish Exhib., London, 1883, p. 36; Trans. Fish Cult. Assoc., 1884, pp. 34, 39.

Coregonus merki, JOR. & GILB.
Syn. Fish N. A., 1883, p. 300.
Not *Coregonus merkii*, GÜNTHER, Cat. Fish. Brit. Mus., VI, 1866, p. 195.

This small species occurs in northern Alaska from the Yukon River northward. The largest individual we have seen is 11½ inches long and was collected in Putnam, or Kuwuk River, Alaska, by Mr. Charles H. Townsend. This example is made the type of the species.

I have long doubted the identity of this species with the *merkii* of Günther and am now convinced that the two are distinct.

The type of *Coregonus pusillus* has forty-nine long and slender gill-rakers; the eye is nearly one-fourth, maxilla three-tenths, and mandible three-sevenths length of head. The longest dorsal ray is two-thirds length of head; the head is one-fifth of the total to end of scales. The maxilla does not extend to below the middle of the eye, and the articulation of the mandible is not far behind a vertical through the middle of the eye. The interorbital space equals the length of the eye and is somewhat greater than the length of the snout. The longest gill-raker is about two-thirds as long as the eye. The greatest height of the body slightly exceeds the length of the head; the least height of the tail is about two-fifths the length of the head.

The adipose fin is moderately large, its length about equal to the diameter of the eye. The origin of the dorsal is over the twenty-ninth scale of the lateral line, and the ventral origin is under the thirtieth scale. The length of the pectoral equals the length of the head without the snout; the length of the ventral is about two-thirds that of the head. The distance from the extended ventral to the vent equals the length of the ventral. The anal origin is under the sixty-second scale of the lateral line; the length of the anal base equals two-thirds the length of the head and the longest anal ray is one-half as long as the head. The length of the middle caudal rays, from the end of the scales, is one-third of the length of the head and about two-fifths the length of the external rays.

The dorsal has nine or ten divided rays; anal eleven or twelve divided rays; ventral I, 11; pectoral I, 15; scales 10—91—9.

LIST OF PLANTS COLLECTED BY DR. EDWARD PALMER IN LOWER CALIFORNIA IN 1889.

BY DR. GEORGE VASEY AND JOSEPH N. ROSE.

Dr. Edward Palmer was employed by the Department of Agriculture to make botanical investigations and collections in California and adjacent parts. In January, 1889, he began his collections at San Quentin, in Lower California; next he proceeded to Lagoon Head; then to Cedros Island and San Benito Island, and lastly off the west coast to Guadalupe Islands.

The specimens were all carefully examined and determined, so far as possible, at the herbarium in the Agricultural Department, and finally corrected by a study of the types in the Gray herbarium. Dr. Sereno Watson very kindly and willingly looked over our specimens and gave very valuable suggestions as to where certain puzzling forms should go.

1. PLANTS COLLECTED AT SAN QUENTIN.

During January and the first part of February last, Dr. Palmer was engaged in collecting in the region about San Quentin Bay. Although some of our best collectors have visited this region, yet none probably have collected so largely and thoroughly. While a number of new species were found, the collection is also especially valuable in the number of old but rare species, and in extending the range southward of other more common ones.

In this paper each species is preceded by the number under which it is to be distributed. Those numbers under 700 were collected in January, while 700 to 740 were collected in February.

600. **Platystemon Californicus** Benth.
680. **Meconopsis heterophylla** Benth.
739. **Eschscholtzia Californica** Cham.
707. **E. peninsularis** Greene.
611. **Draba cuneifolia, var. brevipes** Watson.
734. **Cheiranthus asper** C. & S.
725. **Sisymbrium canescens** Nutt.
731. **S. reflexum** Nutt.
723. **Tropidocarpum gracile** Hook.

Very rare and only two specimens collected. This extends its published range considerably southward.

671. **Capsella divaricata** Walp.
621, 673. **Lepidium nitidum** Nutt.
728. **Frankenia Palmeri** Watson.
732. **Tissa macrotheca** Britton. (*Lepigonum macrothecum*, F. & M.)

This extends the range of this species south of that given by Mr. Britton in his recent paper on the genus.

733. Calandrinia caulescens H. B. K., var. **Menziesii** Gray.

Very common.

712. C. maritima Nutt.

Stems 2 to 10 inches high, erect and simple, rarely with spreading branches at base; flowers in an umbel like cluster; pedicels 3 to 8 lines long; petals 5, small, reddish; stamens 3 or 4; stigma capitate, barely three-lobed. This is a very rare and little-known species, only having been previously collected by Nuttall, Thurber, and Parry. This year also by Lieutenant Pond.

709. Claytonia parviflora Dougl.

Common.

616. Malvastrum Thurberi Gray.

681. M. exilis Gray.

Leaves deeply cleft and more sharply toothed than the species.

693, 624. Sphæralcea ambigua Gray.

Not before reported from Lower California, although Orcutt probably got it from Japa.

676. Erodium cicutarium L. Her.

618. E. moschatum L. Her.

715. E. Texanum Gray.

666a. Lupinus.

Stems 5 to 10 inches high, branching at base, pubescence of long and scant hairs; leaflets (3 to 6 lines long) oblanceolate, on long petioles; flowers scattered and small (3 to 4 lines long), violet with yellow keel; pods one-half inch long, five to six seeded; seeds brownish, mottled with black, only one line in diameter; bract deciduous. As we have the genus represented in the National Herbarium our plant seems nearest to *L. Arizonicus*, Wat. Its small and scattered flowers also seem to place it in this section. A comparison with the Cambridge specimens indicated a close relationship with *L. nanus*. Orcutt and others have distributed as *L. micranthus*, Dougl., a somewhat similar form. With so many uncertain forms before us we leave this until a revision of the genus is made.

666. Lupinus micranthus Dougl.

716. L. affinis Agard.

697. Trifolium tridentatum Lindl.

613. T. gracilentum T. & G.

669a. Hosackia maritima Nutt. ?

Form, growing with the next.

669. H. stigosa Nutt.

The typical form; very common.

690. H. (**Syrmatium**) **Watsoni** n. sp.

Stems shrubby at base, 1 and 2 feet high, branches weak ascending, growing parts silky, older parts puberulent; leaflets mostly three, 2 to 4 lines long, obovate to oblanceolate, abruptly acute; umbels two to many flowered, on peduncles 1 to 2 inches long (sometimes shorter),

with an ovate bract; calyx 2 lines long with short and acute teeth; flowers 4 to 5 lines long, dark purple in bud, becoming orange; pods two or three seeded, slightly incurved.

This plant is nearest *H. juncea*, but differs in its long peduncled umbels, acute calyx teeth, etc. We take pleasure in dedicating this new species to Dr. Sereno Watson.

637. **H. Palmeri** n. sp.

Seemingly nearest *H. prostrata*, Nutt. Annual, 1 to 2 feet high, branching, pubescent when young, becoming nearly glabrous; leaflets, three to seven (mostly five), 4 to 6 lines long, on a somewhat winged rhachis, ovate to oblong, obtuse; the capitate umbels many-flowered (sometimes one or two), with ovate bract, on slender peduncles (1 to 1½ inches long); calyx pubescent even in fruit; teeth minute; flowers, 2 to 3 lines long, "scarlet;" style glabrous; pods two-seeded, much coiled.

Differs from *H. prostrata* in its more erect habit, larger, less crowded leaflets, longer peduncles, and coiled pods, etc.

614. **Astragalus didymocarpus** H. & A.

646 and 700. **A. Hornii** Gray.

719. **A. triflorus** Gray.

Also collected here by Orcutt in 1886.

619. **Rosa minutiflora** Engl.

Has also recently been collected by Orcutt, Pringle, and Parry.

670. **Lathyrus paluster** L.

741. **Ribes Palmeri** n. sp.

Stems several feet high, the younger parts with a close white pubescence, leaves 6 to 10 lines broad, oval, three to five lobed, lobes crenate; racemes, ten to fifteen (sometimes only two to five), flowered, in fruit becoming a compact spike on short, stunted branches; calyx tube short, 1½ lines long, reflexed lobes almost as long; anthers sessile, petals minute, fruit red, 2 lines in diameter, ten-seeded. In fruit in February. Also collected by Orcutt in 1883 in Guadalupe Mountains, Lower California, in Herb. Gray.

738. **Eulobus Californicus** Nutt.

San Quentin, February, 1889. Lagoon Head, November 10 (806). We find no specimens of this species from Lower California, either in the National or Gray Herbarium.

617. **Œnothera micrantha** Hornemann.

Stems 1 to 20 inches high, erect or prostrate, the petals often reddening on drying, and having a black spot at base, as in *Œ. bistorta.* Later on, a peculiar form was collected, acaulescent or with short branches (with much the habit of *Œ. breviflora*); capsules many, crowning the slender tap-root, about 9 lines long, becoming reflexed.

663. **Œnothera trichocalyx** Nutt.?

Annual or biennial, acaulescent (sometimes caulescent) from a long slender root, leaves 2 to 8 inches long, lyrate-pinnatifid, or the lower

Sept. 20, 1889.

ones often entire, on long petioles; calyx tube, $1\frac{1}{2}$ inches long, slender; petals obcordate, 9 lines long; capsules becoming reflexed in age and burying themselves in the sand; flowers rose-colored. The whole plant more or less purplish, much resembling *Œ. primiveris*, but capsule and seeds very different.

668. **Megarrhiza.**

Perhaps distinct but nearest *M. Californica.* Fruit globose, 2 inches in diameter, covered with weak, slender spines 8 to 10 lines long by 4 to 5 broad. The large root is used as a medicine.

643. **Apiastrum angustifolium** Nutt.
678. **Galium aparine** L., var. **Vaillantii** Koch.
635. **Aplopappus fasciculatus** n. sp.

Belonging to the § Aplopappus proper. Herbaceous, a foot or two high, glabrous; leaves entire, linear-spatulate (1 to $1\frac{1}{2}$ lines long), acute, fascicled in the axils; heads five to ten, in cymose clusters, 3 to 6 lines high; bracts well imbricated in three or four series with indefinite green tips; rayless; akenes pubescent; style tips short, broadly ovate.

724. **Pleuchea borealis** Gray.
605. **Styloclyne gnaphaloides** Nutt.
699. **Gnaphalium Sprengelii** H. & A.

But a single specimen collected.

674. **G. microcephalum** Nutt.

Not common.

622. **Franseria chenopodifolia** Benth.

This species, which for so long a time was unknown and variously referred to *F. deltoidea* and *F. eriocentra*, seems to be rather widely distributed. Orcutt collected it at All Saints Bay, 1885, by means of which Dr. Gray re-established Bentham's species; also collected by Hinds at Bay of Magdalena, E. L. Greene at Cedros Island, and now by Dr. Palmer at San Quentin.

664. **Viguiera laciniata** Gray.
661, 662. **Encelia Californica** Nutt.
677. **Leptosyne Douglassii** D. C.

Its most southern range.

602. **Layia elegans** T. & G.

The rays are only yellow near the base, the remainder purple or white, three-quarters of an inch long, the hairs on the pappus sparse and hardly woolly, and about one-third their length. Stems mostly simple; only the uppermost leaves entire. Orcutt has also collected a purple-flowered form at All Saints Bay (1885).

634. **Baeria gracilis** Gray, var. **paleacea** Gray.

Plant much branched and spreading at base; heads 2 to 3 lines high; bracts six to eight, erect and close; rays small (1 to 2 lines), barely exserted. Collected by Orcutt in 1884 and distributed as the var. *tenerrima.* This plant differs somewhat from the var. *paleacea* in most herbarium specimens, but Orcutt's plant was referred here by Dr. Gray.

736. Baeria uliginosa Gray.

This plant differs somewhat from most of the forms of this species seen. The receptacle is obtusely conical and puberulent, the involucral bracts narrower and longer, and the stem 1 to 2 feet high. The leaves are mostly entire towards the base, with the apex cut into long linear lobes. Our plant most resembles 466 of Kellogg & Harford, which was distributed as *B. Fremontii*, but referred by Dr. Gray in his Herbarium to *B. uliginosa*, and yet from his notes he considered it a peculiar form.

665. Chænactis lanosa D. C.

Grows very plentifully about San Quentin, but not before reported so far south.

644. Senecio Lyoni Gray.

Before only reported from San Clemente Island by Nevin & Lyon (1885). The present plant differs somewhat from the type. It is taller and more branching, the wool in the axils not quite so abundant, the pedicels longer (sometimes 2 inches), and somewhat spreading.

659. Senecio peninsularis n. sp.

Two feet high, much branched, glabrous; leaves bipinnate, segments linear, and with a broad auriculate base; the heads in a corymbose cyme; the longest pedicels 2 to 3 inches long; heads large (6 lines high), rays conspicuous and dark yellow; involucre somewhat open, with tapering black tips, hairy when young. Akenes with a short dense white pubescence. Closely related to *S. Lyoni*, but differs in the broad auriculate base of the leaves; no wool in the axils; rays larger and darker colored.

606. Senecio sylvaticus L.

691. Trixis angustifolia D. C.

The typical form is rarely collected so near the coast.

615, 625, 626. Microseris linearifolia Gray.

This species is quite variable here, but the smaller forms are more common.

607. Sonchus tenerrimus L.

Supposed to have been introduced from Southern Europe, but rarely met with, and only reported by Nuttall and by Orcutt in 1884.

639. Philibertia linearis Gray, var. **heterophylla** Gray.

650. Gilia (Siphonella) laxa n. sp.

Annual, sweet-scented, 4 to 9 inches high, slender and weak, either simple or much branched; leaves divided into three to five linear segments (5 to 10 lines long), upper ones often alternate; calyx 2 lines long, cleft almost to the base; corolla lobes but 2 lines long; capsule 1 line long, four seeds in each cell. The characters of the section *Siphonella* must be somewhat enlarged to admit this species, as its relationships are certainly here, notwithstanding these differences. It is nearest *G. floribunda*, but differs in being an annual, in its weak and straggling habit, more simple inflorescence, and smaller flowers.

648 and 649. Gilia dianthoides Endl.
638. Ellisia membrancea Benth.
673. Ellisia chrysanthemifolia Benth.
701. Phacelia Parryi Torr.

A very handsome and common plant.

692. Phacelia hirtuosa Gray.

This was the last *Phacelia* described by Dr. Gray and has only been found once before: Orcutt, at San Telmo, Lower California, and now at San Quentin.

645. Phacelia tanacetifolia Benth.
660. Phacelia (Eutoca) Palmeri n. sp.

Small, decumbent or ascending, annual, pubescent and somewhat hirsute; leaves all radical, pinnate, the alternate ones three-lobed, the others entire, the segments small, obtuse. Flowering branches 2 to 8 inches long, flowers scattered (the earliest ones often form single peduncles); pedicel short (1 to 3 lines) at first spreading, in age brought close to the axis. Calyx in fruit 3 lines long; the sepals obovate, becoming spatulate; corolla "bluish white," scarcely longer than calyx, barely 2 lines high, 3 lines wide, stamens included, with appendages small; style cleft for two-thirds its length. Capsule pointed, very hairy along the lines of dehiscence; seeds thirty, minute (one-fourth line in diameter), closely related to *P. Douglasii*, but differs in leaves, flower, style, seeds, etc.

627. Pectocarya linearis D. C.
628. P. penicillāta D. C.
608. Krynitzkia intermedia Gray.
695. K. muricata Gray.

Very common.

631 and 695. K. Jonesii Gray.

This species has been seldom collected before, but is quite common about San Quentin Bay. It seems quite distinct from the above species.

630 and 698. K. ramosissima Greene.

Stems 3 to 7 inches high; leaves 3 to 12 lines long; nutlets often two, and one slightly larger (2 to 3 lines long); smooth and lucid; the other obtuse and slightly muriculate. This species seem to be too near *K. maritima*.

612. Amsinkia intermedia F. & M.
607. A. spectabilis F. & M.
704. Solanum Palmeri n. sp.

Belonging in the section containing *S. triquetum*. Stems angled and pubescent with branching hairs, a foot or so high. Leaves 1 to 1½ inches long, deeply three-lobed; the lateral ones small, ovate, the terminal one ovate to lanceolate; the umbel terminal two to six flowered; corolla 3 to 4 lines wide, violet, greenish at base, five cleft, pubescent without; pedicels 6 to 10 lines long, fruit yellowish (?), 8 lines in diameter. San Quentin, February 1, 1889.

647. Solanum nigrum L. Var.

Leaves conspicuously angulate-dentate, corolla 6 lines wide, filaments hairy at base; style hairy the lower half.

682. Physalis crassifolia Benth. ?

Apparently an annual, the corolla (10 lines broad) is larger and the sepals acute. This seems to be the same as the *Physalis* collected by Dr. Streets, at Cedros Island, in 1869. Perhaps new.

688. Nicotiana Clevelandi Gray.

A rare species. The lower leaves sometimes a foot long, including the petiole.

658. Linaria Canadensis Dumont.

657. Antirrhinum Watsoni n. sp.

Slender, erect, 1 to 1½ feet high, often simple, almost glabrous; leaves 1 to 1½ inches long, linear to narrowly lanceolate; pedicels 5 to 12 lines long; calyx glabrous or sparsely pubescent; sepals (1 to 1½ lines long) almost equal, all shorter than the capsule; corolla pubescent (3 to 4 lines long), "violet, white veined," its tube longer than the sepals; the lips prominent; the palet covered with yellow hairs; persistent style (1 to 1½ lines long) glabrous, equaling the slightly oblique, globular capsule. Flowering February to March. Closely related to *A. Kingii*, Watson, but of entirely different range, and flowering earlier; also in its long pedicels, equal sepals, larger flowers, etc. "Northwestern Mountains," Sonora (Pringle, March 26, 1884), Los Angeles Bay (Palmer, 1887), and now at San Quentin.

Antirrhinum Kingii, var., Watson, Proc. Am. Acad., Vol. XXIV, p. 66.

735. A. subsessile Gray.

720. Galvesia juncea Gray.

This is *Antirrhinum junceum* in Syn. Flora. Good specimens were collected in flower and fruit in February. San Quentin. First collected on Cedros Island by Dr. Streets.

642. Castilleia affinis H. & A.

Considerably out of its range.

620. Salvia Columbariæ Benth.

With small forms barely 2 inches high; the largest forms sometimes bearing 3 whorls of flowers.

610. Audibertia stachyoides Benth.

The more glabrous form; stems slender, leaves oblanceolate, ¾ to 1½ inches long. Three to six very distant and small heads; the bracts and calyx not oval, pubescent, the latter with teeth almost equal; stamens barely exserted.

654. Plantago Patagonica L.

Common. Collected at various places representing various forms. The var. *nuda* (653), 609 also, San Benito (910).

640. Mirabilis Californicus Gray.

Stems glabrous below, viscid, pubescent, and even scabrous above;

leaves (1 inch long) triangular, cordate at base on petioles almost as long; "flowers light pink."

721. Abronia maritima Nutt.

737. A. umbellata Lam.

689. Rumex hymenosepalus Torr.

653. Nemacaulis Nuttallii Benth.

This species was found in great abundance. While some specimens agree with the published descriptions, yet others have stems perfectly green, taller (1 to 1½ feet high), erect, and with leaves 4 inches long. Besides the collectors given in Bot. California it has been found by Pringle (1882) and Orcutt (1886), Parry, Cleveland, and J. C. Nevin (1882).

722. Chorizanthe Lastarriæa Parry. (*Lastarriæa Chilensis* Remy.)

Very rare here, but common in southern California. Supposed by Dr. Watson to have been introduced from South America. (Rarely found in herbaria.)

657. C. Parryi Wats.

652. C. procumbens Nutt.

729. Eriogonum fasciculatum Benth.?

A well-marked form, and perhaps distinct. Stems almost glabrous; the leaves are glabrous above; peduncles very short or none; inflorescence more open.

667. Pterostegia drymarioides F. & M.

696. Harfordia macroptera Greene & Parry.

705. Aphanisma blitoides Nutt.

Said in Bot. California to have been sparingly collected at San Diego by Nuttall and Cleveland, but since obtained there by most of our western collectors. Very abundant about San Quentin.

717. Atriplex microcarpa Diet.

718. A. Californica Moq.

726. A. Julacea Watson.

632. Hesperocnide tenella Torr.

604. Euphorbia polycarpa Benth.

711. Juncus bufonius L.

A simple form; stems 6 to 15 lines high, mostly single-flowered.

623. Brodiæa capitata Benth.

703. Polypodium Californicum Kaulf.

633. Gymnogramme triangularis Kaulf.

730. Pellæa andromedæfolia Fee.

2.—PLANTS COLLECTED AT LAGOON HEAD.

From March 6 to 15 Dr. Palmer was at Lagoon Head, the Cabo-Negro of the old Spanish charts, in latitude 28 degrees. This point is said to be the termination of vegetation on the Pacific coast before reaching the sand waste around Scammond's Lagoon. Not only did he collect about the coast, but inland some 40 miles, finishing at Rosalia Bay. Here the vegetation is very peculiar, and said to be the point where

the rainy season of southern California and Mexico unite. Here he was very successful in collecting many rare and valuable specimens. These were collected under many difficulties and dried on ship-board. On his way to San Diego his precious cargo was almost lost in the terrible storm which visited the coast the last of April. Only a partial list is now given, the remainder to follow in another paper.

806. Eulobus Californicus Nutt.

816. Œnothera primiveris Gray.

Leaves sometimes 7 inches long, petals 15 lines long, "sulphur yellow," becoming purple in drying, closes by day. Sandy low places among hills 40 miles back from the sea. This extends the range of this species considerably; it has only been reported from Utah, New Mexico, and western Texas.

807. Viguiera deltoidea Gray.

The rediscovery of this species after a lapse of thirty years is of considerable interest. It was collected by L. J. Xantus in 1859, probably near Cape St. Lucas, Lower California, and described by Gray in Proc. Am. Acad., Vol. v, p. 161. Very poor specimens were collected, and there has been ever since considerable uncertainty respecting its habit. It is a very common plant on hills 40 miles back from the ocean, 3 to 4 feet high, shrubby at base, large, showy, orange-colored flowers, and quite fragrant. It much resembles *V. Parishii* of more northern range, but the inflorescence is more crowded, the heads sessile or on short peduncles, while *V. Parishii* has its flowers mostly single on long peduncles.

270. Viguiera microphylla n. sp.

Stems shrubby at base, about 2 feet high, covered with a white, close pubescence; leaves deltoid, entire, 3 to 9 lines long, on short petioles; heads two to four, on long, slender, naked peduncles; heads 4 to 6 lines; rays 3 lines long; akenes 2 lines long, covered with long silky hairs; pappus two, slender paleæ, with one to three intermediate paleæ, which are broad and laciniate. Should follow *V. laciniata*, Gray. "Loose-growing plant with bright yellow flowers." Forty miles back from the ocean.

804. Encelia laciniata n. sp.

Two to 3 feet high, woody at base, slightly pubescent, becoming glabrous; leaves 2 inches long, ovate, with a slender, cuneate base, laciniately serrate; peduncles 2 to 3 inches long. Heads 9 lines broad, nodding after anthesis; the involucral bracts lanceolate, somewhat tomentose; rays yellow, disk reddish; akenes 2½ lines long, obovate, no pappus, margins long, densely villose. Grows on sand plains and hills above the bay.

805. Encelia Palmeri n. sp.

Stems compact, 3 feet high, with a short white tomentum, becoming green and scabrous above; leaves whitish-hirsute, becoming green and

glabrous, broadly ovate, cordate at base, entire or slightly serrate, 1 to 1½ inches long, on short, naked petioles, upper ones reduced to small bracts, heads on long peduncles, 6 to 12 lines broad; rays yellow, twenty, 3 to 4 lines long; disk brownish. The involucral bracts lanceolate, greenish above, below covered with long, white, villose pubescence. Akenes 2 lines long, no pappus, the margins long-villose, the sides glabrous. Common about the Bay Lagoon Head, Lower California, March 7 to 15, 1889.

803. **Gilia Palmeri** Watson.

This is the second station for this recently (1889) described species. First collected at Los Angeles Bay, by Dr. Edward Palmer, in 1887, and now on the other side of the peninsula, but 40 miles back from the coast. The specimens of this year make necessary a few changes in the original description. The stem is biennial, very woody at base, somewhat taller, peduncles often 2 inches long. "Gravelly hills, grows scatteringly, bloom pink color." March 6 to 15. Lagoon Head.

808. **Nama demissum** Gray.

The range of this plant is only given as far south as the southwestern borders of California in Syn. Flora. And so far as herbarium specimens go, none have been seen from Lower California. It was collected 40 miles back from the ocean in the sandy valleys. Dr. Palmer speaks of it as "a showy plant; grows quite thick, forming large patches; bloom violet."

801. **Krynitzkia Grayi** n. sp.

Small annual, 1 to 3 inches high, hispid; leaves filiform, a half-inch long; spikes bractless, simple or in pairs, closely flowered; calyx barely a line long, open in fruit; nutlets one-third of a line long, ovate, trigonous, grayish, muriculate-roughened; ventral groove broad, triangular at base, closed above; the style twice as long as the nutlets. Abundant in low places between hills. Growing with *K. maritima*. It comes between *K. ambigua* and *K. micromeres*; the calyx is more like *K. ambigua*, while the fruit resembles more closely *K. micromeres*, but totally different from either.

NOTES ON COSTA RICAN BIRDS, WITH DESCRIPTIONS OF SEVEN NEW SPECIES AND SUBSPECIES AND ONE NEW GENUS.

BY ROBERT RIDGWAY.

With their accustomed liberality, the authorities of the National Museum of Costa Rica have sent me for examination a large collection of birds from that country, and given permission to describe any that were new to science. The collection, while consisting chiefly of species that are already known, includes several that are new, one of them being a remarkable new genus of uncertain affinities, besides others which are worthy of mention on account of their rarity. For the privilege of describing these interesting novelties my thanks are specially due to Señor Anastasio Alfaro, the accomplished director of the Costa Rica National Museum, and to Señor José C. Zeledon, already well known for his active work in developing the ornithology of that interesting portion of Central America.

Zeledonia, genus novum.

CHAR.—Somewhat like *Catharus*, but wing still more rounded (primaries very little longer than secondaries), first quill about four-fifths as long as second, tail very short (much shorter than tarsus and middle toe together), rictal bristles very weak, and loral feathers well developed and closely appressed. Coloration (of type): Dark olive-green above, deep slate-gray beneath, the crown brownish orange, with a black stripe along each side.

This remarkable new genus is so peculiar in its characters that I am in much doubt as to which family it belongs. The very short rounded wing with long first primary, full and closely appressed loral feathers, and soft texture of the plumage in general strongly suggest the genus *Scytalopus*, and I was at first inclined to refer it to the *Pteroptochidæ*, to which *Scytalopus* belongs; the coloration of the head strongly suggests that of *Basileuterus coronatus*, and the loose-webbed rectrices with finely acuminate points, as well as the loosely-webbed remiges, slender bill, and long-booted tarsi with sharp posterior edge remind one of *Catharus gracilirostris*, to which genus Mr. Alfaro, the collector, had referred the bird. There are apparently only 10 rectrices, and I am able to count only 18 remiges, the latter being the number possessed by the above-mentioned *Catharus*,* which, however, has 12 rectrices. The general resemblance to the genus *Xenicus*, of New Zealand, is very remarkable, *X. longipes* being of nearly the same size and proportions, as the following will show:

* *C. melpomene*, *C. frantzii*, *C. dryas*, *C. occidentalis*, and related species possess 19 remiges.

	Length (skin.)	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.	Number remiges.	Number rectrices.	Covering of tarsi.
Zeledonia coronata	4.35	2.40	1.55	.57	1.02	.60	18?	10?	Faintly scutellate in front with sharp posterior edge.
Xenicus longipes...........	4.25	2.20	1.15	.62	1.02	.65	19?	10	Do.

The difference in coloration is not great, both being plain olive or olive-green above and plain grayish beneath; but while *Zeledonia* has a large brownish-orange crown-patch, bordered laterally by a black stripe, *Xenicus* has a brown pileum, bordered laterally with black, and a broad white superciliary stripe.

Xenicus is now referred to the *Clamatores;* but whether *Zeledonia* is a related form belonging to the same suborder or an aberrant oscinine type, can not, probably, be determined without examination of its anatomy.*

I have named this genus in honor of Señor Don José C. Zeledon, of San José, Costa Rica, to whom chiefly we are indebted for our knowledge of the richly diversified ornithology of that interesting country.

Zeledonia coronata, sp. nov.

SP. CHAR.—*Adult female* (type, No. 116591, U. S. Nat. Mus., Laguna del Volcan de Póas, Costa Rica, Nov. 23, 1888; A. Alfaro).—Pileum orange-ochraceous, bordered laterally by a rather broad stripe of black; rest of head (including superciliary region), together with under parts, except sides, flanks, and under tail-coverts, plain slate color or slate-gray; hind neck and other upper parts plain dark greenish olive, tinged with brown in certain lights; sides and flanks similar, but paler; under tail-coverts olive-grayish. Bill and feet black; iris black.† Length (skin), 4.35; wing, 2.40; tail, 1.55; culmen, .57; tarsus, 1.02; middle toe, .60.

Campylorhynchus capistratus (LESS.).

A pair of adults belonging to the Costa Rica National Museum agree with other Costa Rican specimens, as well as those from Nicaragua, in the Smithsonian collection, in the characters already pointed out by me (these Proceedings, Vol. X, p. 507) as distinguishing *C. capistratus* from *C. castaneus* RIDGW., of Honduras and Guatemala, except that the back is more deeply and uniformly chestnut. Still the lower back is distinctly spotted with blackish and pale rusty, which is not the case

* Since the above was written I have received from Mr. Zeledon skeletons of *Zeledonia* and *Catharus gracilirostris*, and they are now in the hands of Mr. Frederic A. Lucas, who will prepare a paper giving the results of his comparisons. Mr. Lucas informs me that so far as his investigations have gone they show that *Zeledonia* is not related to *Catharus*, but he is not yet prepared to give any further opinion as to its relationships.

† Fide MS. on label.

ith either the type of *C. castaneus* or a specimen of the same form rom Guatemala.* The distinctly larger bill of *C. capistratus* is well hown by these two specimens, which measure as follows:

No	Collection.	Sex and age.	Length (skin).	Wing.	Tail.	Culmen.	Exposed culmen.	Tarsus.	
18	Costa Rica Nat. Mus.	♂ ad.	6.90	3.15	2.85	1.02	.85	1.00	Trojas, February, 1886.
19	......do	♀ ad.	6.40	2.95	2.50	1.08	.90	.95	San Mateo, January, 1886.

Microcerculus orpheus, sp. nov.

Sp. Char.—Somewhat like *M. philomela* (Salv.), but larger, with much longer bill, grayer under parts, and chiefly unbarred upper surface.

Adult (type, No. 115037, U. S. Nat. Mus., Pacuare, Costa Rica, 1876; Juan Cooper).—Above plain burnt-umber brown, duller anteriorly, darker on rump and upper tail-coverts, some of the more posterior scapulars showing very indistinct dusky terminal bars, and upper tail-coverts very indistinctly barred with dusky; wings dusky blackish, the coverts and tertials broadly bordered with umber brown; tail dusky black. Sides of head light grayish brown, fading into dull brownish white on chin and throat. Chest dull brownish gray, many of the feathers with a darker central spot; breast and middle line of belly with these central dark spots considerably larger and darker, triangular or sagittate in form, the broad terminal margins of the feathers paler brownish gray than the general color, producing a decidedly varied effect; sides, flanks, and under tail-coverts uniform deep vandyke brown. Bill black, the basal half of gonys and lower half of mandibular rami whitish; legs and feet brownish black. Length (skin), 4.30; wing, 2.30; tail, .95; exposed culmen, .70; gonys, .48; tarsus, .98; middle toe, .65.

This bird is clearly distinct from both *M. philomela* (Salv.) and *M. luscinia* Salv., with both of which I have carefully compared it, and it is still less like *M. daulias*, recently described by me in these Proceedings, Vol. X, p. 508, also from Costa Rica, but inhabiting the opposite side (Atlantic coast). No other species of the genus, apparently, are sufficiently related to require comparison.

Geothlypis caninucha icterotis, subsp. nov.

Subsp. Char.—Similar to true *G. caninucha*, but auriculars olive-yellow or yellowish olive, instead of dull gray.

Hab.—Costa Rica.

Adult male (No. 94415, Costa Rica; Dr. Van Patten).—Forehead (for about .12 of an inch above exposed base of culmen), lores, and orbits, deep black, this ending very abruptly beneath posterior portion of eyes,

* In the Ibis for April, 1889 (p. 235), Messrs. Salvin and Godman maintain that this character is inconstant.

about .50 posterior to nostril or frontal apex; crown and occiput d ash gray, the feathers with distinct dusky shaft-streaks, this dull grayi color changing gradually into brownish olive-green on back and oth upper parts, brightest on lesser wing-coverts, upper tail-coverts, and ta auriculars olive-yellow. Chin, throat, and chest, pure rich gambog yellow, becoming paler on other under parts, the sides brownish bu and anal region pale buffy yellow. Upper mandible dusky brown, pal on edge; lower mandible whitish, brownish at tip; legs and feet pa brownish. Length (skin), 4.90; wing, 2.30; tail (much worn at tip 2.60; exposed culmen, .43; tarsus, .90; middle toe, .57.

Young male (No. 2028, coll. Costa Rica National Museum, San Jos Costa Rica, August 15, 1887; A. Alfaro).—Entire pileum and hind nec together with back, scapulars, rump, and upper tail-coverts, dull, rath light brownish olive, the back strongly washed with brown; lesser win coverts, remiges, and rectrices yellowish olive-green; middle and great coverts tipped with light yellowish olive. Sides of head nearly lik pileum, the lores a little more dusky; chin, throat, and abdomen, pa gamboge or primrose yellow (new feathers on throat brighter yellow chest pale yellowish olive, deepening into a brownish tint on sides an flanks.

An adult male in the collection of the Costa Rica National Museu (No. 2027, Los Anonas, August 15, 1887, A. Alfaro) is essentially lik that described above, though in more worn plumage.

Petrochelidon lunifrons (SAY).

An adult female from San José (No. 2314, coll. Costa Rica Nationa Museum, September 3, 1888; A. Alfaro) is distinctly this species, as i also the only other example of the genus that I have seen from tha country, also an adult female (No. 68179, U. S. Nat. Mus., date and pre cise locality unknown).* On the other hand, all but one of the Nationa Museum specimens from Mexico (seven in number) are *P. melanogaste* SWAINS. (=*P. swainsoni* SCL.), which is distinguished chiefly by th very different color of the forehead, which is of the same rich chestnu as the chin and sides of the head.†

Buarremon crassirostris CASS.

A fine adult of this rare species in the collection of the Costa Rica National Museum (No. 1169, Rio Sucio, 1881; J. Cooper), closely resembles the type, but has the sides of the head rather blacker. It measures as follows: Length (skin), 6.35; wing, 3.15; tail, 2.70; exposed culmen, .55; tarsus, 1.15; middle toe, .75. Upper mandible black, the edge

* It belongs to the collection of the Gabb Talamanca Expedition, the collector's number being 218.

† An adult male from Mirador in the National Museum collection (No. 33572, August, 1863, Dr. C. Sartorius) is exactly intermediate between the two, and is probably a hybrid. The forehead is of a very peculiar light brown hue, corresponding almost exactly with the "fawn color" of my "Nomenclature of Colors."

roadly) pale brownish or brownish white; lower mandible brownish hite; legs and feet dusky brown.

yanocorax argentigula LAWR.

Young male (No. 1268, Costa Rica National Museum, slopes of Irazú, osta Rica, June 24, 1887; José C. Zeledon).—Similar to the adult, but ght bluish mark across anterior part of crown barely indicated; the est of the crown, occiput, hind neck, and back dull blue, brightest on op of head; wings and tail rather deep blue, and under parts duller nd less purplish blue; whitish throat-mark as in adult, but lacking he delicate purplish tinge.

Young female (No. 116580, U. S. Nat. Mus., same locality, date, and ollector).—Similar to the young male, but no trace of the lighter mark cross anterior part of crown, the entire pileum, except frontlet and asal bristles, being uniform dull blue.

Four adults, from the slopes of the Volcan de Irazú, present the folowing slight variations:

Compared with the type they all have the throat-patch decidedly aler, its color being silvery white, with a very faint purplish tinge, intead of light silvery gray, with a very strong tinge of purplish blue. The mark on top of the head is likewise much paler, the transverse anerior portion being silvery white (faintly tinged with purplish blue in wo specimens), the longitudinal supra-auricular portion pale purplish lue. In the type, this ∩-shaped mark is throughout of pale campanula-blue tint, but appreciably paler on the broader anterior portion than oward the extremities of the lateral arms. The blue of the remiges and rectrices is also of an appreciably greener or less purplish cast than n the type.

It is possible that these differences may be to a degree owing to different ages of the feathers, the plumage of the type being apparently fresher than that of the other specimens.

The five adults measure as follows:

			Wing.	Tail.	Culmen.	Bill from nostril.	Tarsus.	Mid. toe.
No. 67963	U. S. National Museum	♀? ad	4.75	5.20	1.15	.65	1.35	.75
No. 116579	......do	♀ ad	4.60	5.00	1.15	.62	1.28	.73
No. 1265	Costa Rica National Museum	♀ ad	4.70	5.30	1.15	.65	1.30	.71
No. 1252	......do	— ad	4.90	5.40	1.15	.70	1.32	.....
No. 1260	......do	♂ ad	4.50	4.70	1.18	.65	1.37	.....

Xiphocolaptes emigrans costaricensis, subsp. nov.

SUBSP. CHAR.—Similar to *X. emigrans* SCL., from Guatemala, but buffy streaks on breast broader and size somewhat greater.

Type, No. 115041, U. S. Nat. Mus., Naranjo, Cartago, Costa Rica, August, 1886; José C. Zeledon.

This bird is described in detail on a subsequent page of these Proceedings.

Picolaptes gracilis, sp.

SP. CHAR.—Nearest *P. lacrymiger* BP. in coloration of the under parts but upper surface somewhat as in *P. falcinellus* (LICHT.), and bill muc smaller than in either.

Adult female (type, No. 115039, U. S. Nat. Mus., Monte Redondo, Cost Rica, July 25, 1887; A. Alfaro).—Pileum, hind neck, back, scapular and wing-coverts light sepia-brown or bistre, but this broken, excep on lower back, scapulars, and wing-coverts, with broad guttate mesia streaks of pale buff, bordered with blackish, the latter almost forming th ground-color on top of the head. Tertials, greater part of secondarie and primaries (except basally, where more olivaceous), rump, uppe tail-coverts, and tail plain chestnut or hazel, the terminal portion o inner webs of primaries dusky. Sides of head and neck pale buffy streaked with brownish black or dusky brown; chin plain pale buffy throat similar, but feathers narrowly bordered with dusky, producing squamate appearance. Ground color of other under parts hair-brown but this relieved by broad mesial streaks of pale buff, each margine laterally by a narrower but very distinct blackish streak; these mark ings, especially the blackish streaks, becoming nearly obsolete on belly flanks, and under tail coverts. Bill blackish, with basal half of lowe mandible whitish; legs and feet dusky; "iris black." Length (skin) 7.10; wing, 3.55; tail, 3.60; the lateral feathers 1.05 shorter; expose culmen, .81; tarsus, .85.

The only Central American species at all closely related to the presen one is *P. compressus* Cab., which comes rather close in the coloration o the upper parts, which, however, are decidedly more rufescent; but th lower parts are very decidedly different, the lighter markings being i *P. gracilis* much paler (buffy whitish instead of deep buff), and th blackish streaks much broader; besides, *P. compressus* has the bil much longer, and light brown instead of mainly blackish.

Sclerurus canigularis, sp. nov

SP. CHAR.—Similar to *S. albogularis* SWAINS., but much darker, th throat ash-gray (whitish on chin), the back, etc., deep vandyke brown and lower parts dark slaty tinged with brown.

Type, No. 115038, U. S. Nat. Mus., male adult, Turrialba, Costa Rica August, 1886; J. J. Cooper. (Described in detail on a subsequent page of these Proceedings.)

Lophornis adorabilis SALV.

A very perfect adult male, obtained by Mr. José C. Zeledon at San José, October 7, 1886 (No. 1690, Nat. Mus. Costa Rica). "Bill coralline, tip black."

Chætura brunneitorques LAFR.

An adult male in the collection of the National Museum, Costa Rica, (No. 1609, San José, May 10, 1885, J. C. Zeledon), is brighter colored

han the one from the same country in the Smithsonian collection (No. 5056, San José, August 30, 1883, J. C. Z.). the dusky of the lower parts being blacker and more uniform, the rufous-chestnut collar more continuous in front and richer in color, and the fore part of the head blacker. Length, skin, 4.60; wing, 5.20; tail, 2.

Picumnus flavotinctus sp. nov.

SP. CHAR.—Similar to *P. olivaceus* LAFR., from Colombia, but brighter olivaceous above, lower parts more yellowish, with chest deeper olivaceous, and streaks of sides, etc., broader and less distinct; male with crown flecked with dull light orange, instead of deep orpiment-orange, the spots much smaller and covering a more restricted area; female with white specks on hinder crown and occiput much smaller as well as sparser.

HAB.—Costa Rica (Pacific side) to Panama.

Adult male (type, No. 116593, Pozo Azul, Costa Rica, September 6, 1886; José C. Zeledon).—Pileum dull black, the middle of the crown flecked with light dull orange, and occiput minutely dotted with white; hind neck, upper back, anterior scapulars, and wing-coverts plain dull olive, passing into brighter olive on lower back, posterior scapulars, rump, and edges of middle and greater wing-coverts, the upper tail-coverts light buffy olivaceous; alula, primary-coverts, and remiges dull blackish dusky, the secondaries broadly margined with bright yellowish olive, and primaries narrowly edged with dull olive; tail dull black, the middle pair of rectrices with inner web chiefly dull light buffy and two outer pairs broadly tipped with the same, the outer web with an indistinct terminal spot of dusky, and a pale yellowish margin to outer web. Lores and malar region dull whitish, the latter tinged with pale olive and squamated with dusky; auriculars plain olive-brownish; chin and throat pale olivaceous (paler anteriorly), passing into plain rather deep olivaceous, on chest and upper part of breast; rest of under parts pale olive-yellow, rather broadly but not sharply striped with a dull olivaceous. Bill blackish, feet dusky (olivaceous or grayish in life?). Length (skin), 3.80; wing, 2.20; tail, 1.15; culmen, .49; tarsus, .50.

Adult female (No. 116594, same locality, etc.).—Similar to the male, but without orange markings on the crown, white specks on occiput sparser and very minute, and the general coloration paler and duller, especially the lower parts. Length (skin), 3.30; wing, 2.10; tail, 2.25; culmen, .50; tarsus, .52.

Although this bird may prove to be merely a geographical race of the Colombian *P. olivaceus* LAFR., a male from Panama (No. 53959, J. McLeannan) is decidedly referable to it, having the same dull light orange flecks on the crown and deep olivaceous coloration strongly washed with yellowish on the under parts of Costa Rican specimens, as contrasted with the deep orange-red crown-markings and dull olivaceous coloration, without distinct yellow tinge beneath, of the Bogota bird, of which there are four adult males now before me. It should be remarked, however, that this Panama specimen, compared with the

single male from Costa Rica, has the dull yellowish orange flecks on the crown larger, and the stripes on the sides, etc., narrower and more distinct, thus showing a departure toward the characters of the Colombian form and suggesting possible inosculation of the two types.

Myiopsitta lineola (Cass.).

An adult male from Naranjo de Cartago (No. 1819, coll. National Museum of Costa Rica, August, 1886, J. Cooper), agrees closely with specimens from Southern Mexico.*

Mimus gilvus, Vieill.

An adult from Costa Rica (E Zarcero, alt. 7,000 ft., March 1, 1887; José C. Zeledon), in the collection of the Costa Rica National Museum (No. 893), exactly resembles in coloration an adult male from Bogota (U. S. Nat. Mus., No. 32691), its measurements being as follows: Length (skin), 9.70; wing, 4.70; tail (feathers worn at tips), 4.90; exposed culmen, .80; tarsus, 1.35; middle toe, .95.

Carpodectes nitidus Salv.

Immature male (No. 1509, coll. National Museum of Costa Rica, Pacuare, Costa Rica, 1876; Carlos Cervantes).—Similar to the adult male, but terminal third, or more, of five outer primaries and greater portion of the others, slate-dusky; three or four innermost secondaries also marked medially with the same color, which prevails on the last, or terminal half; primary coverts and alulæ also mottled with dusky. Length (skin), 8.50; wing, 5.50; tail, 2.90; exposed culmen, .72; tarsus, .95.

Dendrornis punctigula, sp. nov.

Sp. Char.—Similar in general coloration to *D. triangularis* (Lafr.), but throat spotted instead of squamated, and rump chestnut instead of olive, as in *D. erythropygia*; differing from the latter in much more olivaceous coloration, narrow streaks instead of ovate spots on back, longer bill, and other characters.

Hab.—Costa Rica and Veragua.

Adult male (type, No. 115040, Naranjo, Costa Rica, Aug., 1866; J. J. Cooper).—Pileum deep olive, most of the feathers with very narrow and indistinct shaft-streaks of buff; hind-neck, back, and scapulars, brownish olive (approaching raw umber), the back with mostly narrow and concealed streaks of pale buff; lesser and middle wing-coverts similar to the scapulars, but browner; greater coverts light olive or hair-brown; secondaries, and about the basal half of inner webs of primaries

* A South American form—*Myiopsitta lineola tigrina* (Souancé)—is readily distinguishable by the following characteristics:

Myiopsitta tigrina Souancé, Rev. et Mag. de Zool., 1856, 144 (Venezuela).

Similar to *M. lineola* (Cass.), but rather larger, brighter and darker in color, with black markings on wings, rump, upper tail-coverts, and tail much heavier. (*Cf.* these Proceedings, Vol. IX, p. 94.)

(except outermost), dull hazel or tawny-chestnut; terminal portion of inner webs of primaries (whole inner web of outer quill), abruptly dusky; inner webs of secondaries (except tertials) shaded terminally, next to shaft, with dusky; outer webs of primaries light raw-umber brown, secondaries edged with the same. Lower back, rump, and upper tail-coverts tawny-chestnut; tail clear chestnut, shafts of middle feathers dusky. Chin and throat pale yellowish buff, the latter marked with small diamond-shaped spots of olive, these growing gradually larger and more fan shaped posteriorly; rest of lower parts light greenish olive marked with narrow guttate spots of pale buff, which become narrow streaks laterally, almost disappearing on sides and flanks; under wing-coverts ochraceous, faintly and sparsely speckled with olive. Upper mandible blackish, with whitish tomium; lower mandible entirely brownish white; feet olive dusky.* Length (skin), 8.50; wing, 4.70; tail, 4.15; culmen, 1.32; tarsus, .90; middle toe, .78.

Adult female (No. 51253, Tucurrique, March 30, 186?; J. C. Zeledon).—Not obviously different from the male in coloration, though the upper mandible is brownish for the terminal half. Length (skin), 9.10; wing, 4.15; tail, 3.75; culmen, 1.30; tarsus, .90; middle toe, .70.

A series of 9 specimens from Costa Rica and 1 from Veragua, compared with exactly the same number of *D. erythropygia* SCL., from Mexico (1), Guatemala (7), Panama* (1), and Rio Truando, Colombia (1), agree constantly in the characters above pointed out, and likewise from three examples of *D. triangularis* from Bogota (2) and Guayaquil (1). The Veragua specimen is like those from Costa Rica, except that it has the whole forehead decidedly russet (the streaks pale tawny), probably only an accidental or individual character.

+Dendrocolaptes puncticollis SCL. & SALV.

A specimen in the Lafresnaye collection (No. 2214) in the Boston Society, labeled "*Dendrocolaptes albicollis* VIEILL., y'g, Bahia," is much like *D. puncticollis*, SCL., but is evidently distinct from that species. It certainly is not *D. picumnus* (LICHT.), *D. validus* (TSCH.), *D. certhia* (BODD.), nor *D. sancti-thomæ* (LAFR.), with all of which it has been compared; nor does it agree with the characters ascribed to *D. radiolatus* SCL. & SALV., *D. intermedius* BERL. (also from Bahia), *D. plagosus* SALV. & GODM., *D. pallescens* PELZ., *D. undulatus* (CAB.), nor *D. concolor* PELZ., descriptions of which have been carefully consulted.

Compared with an example of what seems to be *D. puncticollis* from Costa Rica (No. 42158, ♂, Navarro, Feb., 1866; J. Cooper), it is found to differ so much as to forbid its reference to that species, though it is

*An adult male in the collection of the Costa Rica National Museum (No. 2333, San Carlos, December 20, 1888, A. Alfaro) has the Spanish equivalent of the following inscribed on the label: Iris, dusky; feet, blue; upper mandible, black; lower, white.

*I am unable to find the slightest difference between this Panama example and some skins from Guatemala and Mexico.

Sept. 20, 1889

more like that species than any other. I have consequently no resource but to describe and name it as a new species, as follows:

Dendrocolaptes variegatus, sp. nov.

SP. CHAR.—Similar to *D. puncticollis* SCL., but much larger, and lower parts much more broadly barred with dusky; length (mounted specimen), 11.00; wing, 5.80; tail, 5.25; culmen, 1.70.*

From *D. validus* (TSCH.), it differs in being larger, bars on under parts much broader, throat much more distinctly spotted with brown, and in other characters.

SMITHSONIAN INSTITUTION, *June* 29, 1889.

* Corresponding measurements of the specimen of *D. puncticollis*, above referred to are, 9.20 (skin with neck much contracted) 5.00, 5.10, and 1.50, respectively.

REVIEW OF JAPANESE BIRDS.

IX.—THE WRENS.

BY LEONHARD STEJNEGER.

Contrary to what might be expected, a careful comparison of a tolerably good series of Wrens from the islands of Japan proper shows no difference between those inhabiting Yezo and those from Hondo and Kiusiu. Henson's specimen is more like a Nagasaki bird collected by Mr. Ringer (U. S. Nat. Mus. No. 96258) than any other one in the whole series, and as far as coloration is concerned the two birds are practically identical. The other Hakodate specimen before me (U. S. Nat. Mus. No. 96256) is scarcely any paler, while quite as dark and brown as Nos. 91365 and 96257 from Hondo. That the Yezo specimens are in no way larger than those from farther south is manifest from the appended table of dimensions.

On the whole, the large series of specimens before me are very uniform in color and coloration, remarkably so when we consider the variability of conditions under which these birds are found in the Japanese Archipelago and the plasticity of the birds which constitute this genus.

But while Japan proper is only inhabited by one form of Wren, I am forced to acknowledge another as an inhabitant of the Kurile Islands, or some of them, though I have only one specimen to base my conclusions on. The great uniformity of the true *fumigatus* series convinces me, however, that the new form will be found to be at least as valid as *T. borealis*, which bears about the same relationship to the common European Wren as does *T. kurilensis* to its southern neighbor. The difference between the two forms is one of size and is sufficiently indicated in the diagnosis given below.

SUBGENUS **ANORTHURA** RENNIE.

+ (245) **Troglodytes fumigatus** TEMM.

Japan Wren. Misosazai.

1835.—*Troglodytes fumigatus* TEMMINCK, Man. d'Orn., 2 ed., III, p. 161.—SWINHOE, P. Z. S., 1870, p. 602.—*Id.*, Ibis, 1874, p. 152.—*Id.*, *ibid.*, 1875, p. 143.—BLAKIST. and PRYER, Ibis, 1878, p. 238.—*Iid.*, Trans. As. Soc. Jap., VIII, 1880, p. 223.—*Iid.*, *ibid.*, X, 1882, p. 160.—SEEBOHM, Ibis, 1879, p. 37.—BLAKISTON, Chrysanth., Feb., 1883, p. —.—*Id.*, Amend. List B. Jap., p. 56 (1884).—JOUY, Proc. U. S. Nat. Mus., VI, 1883, p. 287.—STEJNEGER, Zeitschr. Ges. Orn., I, 1884, p. 13.—*Id.*, Orn. Expl. Kamtsch., p. 293 (1885).—DYBOWSKI and TACZANOWSKI, Bull. Soc. Zool. France, 1884, Extr., p. 10.—*Anorthura fumigata* SHARPE, Cat. B. Brit. Mus., VI, p. 276, pl. XVI, fig. 1* (1881).—RIDGWAY, Proc. U. S. Nat. Mus., VI, 1883, p. 370.

* In the text (p. 276) the quotation of the figure is erroneous, having been transposed for that on p. 274. On the plate the names are given correctly.

1847.—*Troglodytes vulgaris* TEMM. and SCHLEG., Fauna Japon., Aves, p. 69 (*nec* FLEM.).—BLAKISTON, Ibis, 1862, p. 320.

1855.—*Troglodytes fucatus* BREHM, Naumannia, 1855, p. 285.

1883.—*Troglodytes parvulus* var. *fumigatus* SEEBOHM, Brit. B. Eggs, I, p. 506.—*Id.*, Ibis, 1884, p. 41.

1884.—*Troglodytes parvulus* SEEBOHM, Ibis, 1884, p. 40 (*nec* KOCH).

Measurements.

Museum and No.	Collector and No.	Sex and age.	Locality.	Date.	Wing.	Tail-feathers.	Exposed culmen.	Tarsus.	Middle toe with claw.
....	Henson, 165	♂ ad.	Hakodate, Yezo...	Nov. 7, 1884	52	35	11	18	17.5
U. S. Nat.: 96256	Blak., 1107.......	♂ ad.	....do	Feb. ——	52	34	12	18	17.5
91363	Jouy, 787........	♂ ad.	Tate Yama, Hondo.	Nov. 17, 1882	50	37	11	18	17
91364	Jouy, 828	♂ ad.	....do	Dec. 2, 1882	51	35	11	17	17.5
91366	Jouy, 835.......	♂ ad.	....do	Dec. 4, 1882	49	36	11	18	17
88640	Jouy, 571.......	♂ ad.	Fuji, Hondo	July 20, 1882	49	33	11	18.5	17
91365	Jouy, 834........	♀ ad.	Tate Yama, Hondo.	Dec. 4, 1882	45	32	10.5	15.5	16
91367	Jouy, 839........	♀ ad.	....do	Dec. 4, 1882	47	32	10	16	17
109350	Namiye	♀ (?) ad.	Iwashiro, Hondo ..	Jan. 4, 1886	51	34	11.5	18	.....
96257	Pryer, Bl. 2196...	? ad.	Tokio, Hondo......	Mar., 1877	46	33	10.5	.....	.....
97980	? 7481...........	? ad.	Yokohama, Hondo	....	52	....	11.5	.....	.....
96258	Ringer, Bl. 2817	? ad.	Nagasaki, Kiusiu..	....	50	35	12	17.5	17
114730	Ringer, 32	♂ ad.	Aso Yama, Kiusiu.	Jan. 1, 1887	46	32	11	17	.....
Christiania	Petersen, 130....	? ad.	Kiusiu...........	....	48	34	11	18	17
Do.....	Petersen, 132...	? ad.	....do	....	46	32	11	17	.....

† (245½) **Troglodytes fumigatus kurilensis**, subsp. nov.

Kuril Wren.

1882.—*Troglodytes* —— ?, BLAKISTON and PRYER, Trans. As. Soc. Jap., x, 1882, p. 160.—BLAKISTON, Amend. List B. Jap., p. 56 (1884).

DIAGN.—Similar to *Troglodytes fumigatus*, but somewhat larger, bill and feet being particularly large.

DIMENSIONS (of type).—Wing, 55mm; tail-feathers, 37mm; exposed culmen, 14mm; tarsus, 19.5mm; middle toe, with claw, 19mm.

HABITAT.—Shiashkotan, Kuril Islands.

TYPE.—U. S. Nat. Mus. No. 96259, H. J. Snow, coll., July, 1881.

It has been suspected that this bird might turn out to be the same as my *T. pallescens* from the Commander Islands, but a direct comparison shows that they have nothing in common except the size. My remarks in Orn. Expl. Kamtsch., p. 293, in regard to *T. fumigatus* apply equally well to *T. kurilensis*, as far as coloration is concerned. The last-mentioned two forms agree in color, *T. kurilensis* being perhaps a trifle paler on the middle of the fore neck.

Shiashkotan is one of the northern islands of the Kuril chain, its position being 48° 50′ N. lat., 154° 5′ E. long. It consists of two volcanic peaks about 3,000 feet high, and hot sulphur springs are said to occur. The habitat of this form is therefore not unlike that of *T. borealis* in Iceland.

LIST OF FISHES COLLECTED AT GREEN TURTLE CAY, IN THE BAHAMAS, BY CHARLES L. EDWARDS, WITH DESCRIPTIONS OF THREE NEW SPECIES.

BY DAVID STARR JORDAN AND CHARLES HARVEY BOLLMAN.

In the summer of 1888 a small collection of fishes was made at Green Turtle Cay, one of the Bahama Islands, by Mr. Charles Lincoln Edwards, a worker in the Johns Hopkins biological laboratory.

In the present paper we have given a list of these species with descriptions of the three which appear to be new to science. The types of the new species are in the U. S. National Museum, the others in the museum of the University of Indiana.

1. **Echidna catenata** (Bloch).
2. **Gymnothorax moringa** (Cuvier).

Stilbiscus, gen. nov. (*Congridæ*).

Diagnosis.—Approaching *Neoconger* Girard, from which it can be separated by the following characters: Dorsal and anal fins beginning more than a head's length behind vent and only developed for a distance about equal to length of head, when they almost disappear to reappear near end of tail. Tail twice as short as body; teeth uniserial.

Type.—*Stilbiscus edwardsi* Jordan & Bollman.

Description.—Body very elongate, slender, terete; tail contained about twice in rest of body; lateral line present; head long, pointed, conical; eye small, placed just anterior to angle of mouth, its upper margin opposite posterior nostril; lower jaw projecting; teeth uniserial, canine-like, some of the anterior enlarged; tongue adnate to floor of mouth; anterior nostril near tip of snout, with a short tube; posterior larger near front of eye, and without a tube. Gill-openings small, slightly oblique, not much broader than front of pectoral. Dorsal and anal fins beginning behind vent at a distance equal to head and length of pectoral; developed for about a head's length, then almost disappearing to re-appear about a half head's length from the end of tail. Pectorals developed, their length slightly longer than snout.

3. **Stilbiscus edwardsi**, sp. nov.

Description.—Head $7\frac{1}{2}$ in trunk, $4\frac{1}{2}$ in tail; snout 7 in head, its length somewhat greater than distance between gill-openings; eye $1\frac{1}{5}$ in snout, $1\frac{1}{2}$ in interorbital space. Cleft of mouth reaching to posterior margin of eye; upper jaw 5 in head, lower $4\frac{3}{4}$. Height of gill-opening $1\frac{1}{2}$ in snout. Dorsal and anal beginning $1\frac{2}{7}$ length of head behind vent, their developed part about equal to length of head and pectoral; developed part at end of tail contained $1\frac{2}{3}$ times in head. Pectorals 6 in head. Upper half of head and body above lateral line brown; lower parts of a bright

metallic bluish-silver color. Dorsal and anal fins pale, the latter with a dusky stripe on each side of its base; pectorals dusky; caudal black.

This species is named for Mr. Charles L. Edwards, its discoverer. A single specimen was obtained.

4. **Harengula sardina** (Poey).

5. **Harengula clupeola** (Cuv. & Val.).

6. **Tylosurus notatus** Poey.

7. **Mugil curema** (Cuv. & Val.).

8. **Atherina stipes** Müller & Troschel.

A few specimens. The general coloration is somewhat darker than in specimens from Key West.

9. **Sphyræna picuda** Bloch & Schneider.

10. **Echeneis naucrates** Linnæus.

One specimen almost ten inches long. D. XX, 30; A. 31.

11. **Caranx bartholomæi** Cuv. & Val.

12. **Caranx crinitus** Mitchill.

13. **Holocentrus ascensionis** (Osbeck).

14. **Holocentrus coruscus** Poey.

Holocentrum coruscum Poey, Memorias, II, 159, 1860 (*Cuba*).

Head $2\frac{4}{5}$ ($3\frac{1}{2}$); depth $2\frac{2}{3}$ ($3\frac{1}{3}$). D. XI, 14; A. IV, 9. Scales 3–42–8. Body shaped as in *H. suborbitalis*, a Pacific coast species, to which it is nearly related. Eye very large, $2\frac{1}{3}$ in head. Snout very short, 2 in eye. Mouth small, maxillary reaching past anterior margin of pupil, 3 in head. Width of interorbital space not as long as maxillary, $3\frac{1}{3}$ in head. Bones of top of head marked as in *suborbitalis*, except that a few of the upper occipital ridges are serrated. Spines on preopercle, opercle, interopercle, preorbital and suborbital as in the Western species; spines on subopercle a few more; scales on body as in *ascensionis* or *suborbitalis;* nuchal scale as large as in the latter; five rows of scales on cheek, none on opercle.

Spinous dorsal moderately high; first spine 3 in head; third spine longest, $2\frac{1}{4}$ in head. Soft dorsal higher than spines; not falcate, as in *ascensionis;* longest ray $1\frac{5}{7}$ in head. Third anal spine longest, almost 2 in head; longest ray $1\frac{4}{5}$ in head, not falcate. Pectorals $1\frac{3}{7}$ in head. Ventrals $1\frac{4}{7}$; its outer rays not produced, about two-fifths diameter of eye from vent. Upper caudal lobe apparently not much produced, $1\frac{2}{5}$ in head.

Color in spirits.—Pale silvery, edges of scales showing bright blue steel reflections; a reddish shade above lateral line. Bands of dots following rows of scales, those below lateral line widest and most diffused. No markings on head with the exception of dots. Spinous dorsal dusky; a large black spot between first and third spine; membrane between bands of posterior spines with dusky spots; a row of whitish angular spots on the anterior part of membrane between each two spines, those between the third and sixth spines longest, the two

anterior well developed below the large black spot. Other fins pale; upper angle of pectoral with a group of dots.

The above description was taken from a young specimen two inches long.

15. **Mycteroperca venenosa guttata** (Linnæus).

16. **Lutjanus jocú** (Bloch & Schneider).

17. **Lutjanus griseus** (Linnæus).

18. **Lutjanus apoda** (Walbaum).

19. **Hæmulon sciurus** (Shaw).

20. **Hæmulon parra** (Desmarest).

21. **Hæmulon rimator** Jordan & Swain.

22. **Calamus bajonado** (Bloch & Schneider).

23. **Platyglossus bivittatus** (Bloch).

24. **Gerres harengulus** (Goode & Bean).

25. **Gerres lefroyi** (Goode).

26. **Sparisoma niphobles** sp. nov.

Diagnosis.—Allied to *S. radians*, *lachrymale*, *hoplomystax*, etc., but not agreeing with the descriptions of any of the species of this type.

Description.—Head, $3\frac{2}{5}$ (4); depth, $3\frac{2}{3}$ ($4\frac{1}{5}$). D. IX, 10; A. 11. Scales, 2–24–6. Length of type, $5\frac{1}{2}$ inches. Body oblong; jaws pale. A small canine directed downwards on each side in front of upper jaw above cutting edge and close to the median suture; another single stout canine directed outwards and backwards on each side of upper jaw in front of angle of mouth; upper lips covering most of upper jaw. Eye moderate, $4\frac{1}{2}$ in head; snout obtuse, $2\frac{1}{5}$ in head; cheeks with one row of five large scales. Tubes of lateral line each with three to five branches, usually three; four scales on median line before dorsal. Caudal truncate, the outer rays not produced, $1\frac{2}{5}$ in head.

Color in spirits.—Brownish olive, the color so mottled and speckled with whitish as almost to hide the ground color. Head much speckled with bluish and black; dark spots smallest and most defined on top of head; brownish regions most prominent around eyes and lower part of cheeks. Chin crossed by a silvery band, behind which is a brownish band, and then a row of six silvery spots, of which the lowermost are largest; an ill-defined whitish band from lower margin of eye across opercle connecting with one above base of pectorals. Scales on body marked like those on head; black spots more prominent above lateral line, the white below pectorals; above five bluish-white stripes following rows of scales, the one above lateral line most prominent, the one under lateral line not distinct. Between the band above lateral line and the one above base of pectorals are five slightly oblique dusky blotches, of which the third (from the head) is least distinct; the last four extend on dorsal fin. Region around caudal fin brownish, the spots less distinct; a small black humeral spot; two scales in front of dorsal dark. Axil rather dark; dorsal with four distinct darker mot-

tled areas, the first between fifth and seventh spines, the second between last spine and third anal ray, the third at base of fifth and sixth rays, and the last on eighth and ninth rays. Upper part of soft dorsal with 2–3 rows of brownish spots. Caudal brownish, with four or five narrow, wavy, white vertical bars, of which the last two are most prominent. Anal with three darker areas, its markings similar to those on dorsal. Pectorals yellowish, spotted at base and near tips of rays. Ventrals faintly brownish and indistinctly spotted with white.

One specimen obtained.

27. **Pomacentrus leucostictus** (Müller & Troschel).

Young specimens have all the region below in line drawn from snout to black spot on soft dorsal light yellowish-brown. In the adult this region is dark brown, like the rest of the body.

28. **Chætodon striatus** (Linnæus.)

The scales are more oblique in this species than would be inferred from the language used in Eigenman & Horning's key to the species of *Chætodon*.

29. **Acanthurus cœruleus** (Bloch).

30. **Acanthurus tractus** Poey.

31. **Acanthurus hepatus** (Linnæus).

32. **Gobius soporator** Cuv. & Val.

33. **Gobiesox hæres** sp. nov.

Diagnosis.—Related to *Gobiesox punctulatus* (Poey), but the body not banded.

Description.—Head $2\frac{3}{5}$ ($3\frac{1}{4}$); depth 6 ($7\frac{1}{2}$) D. 9, A. 6. Length $2\frac{1}{4}$ inches. Body rather slender. Head low and broad, greatest breadth not quite equal to length; its anterior margin not so broadly rounded as in *G. virgatulus*. Eyes very small, $1\frac{2}{3}$ in interorbital space, 5 in head. Interorbital bone appearing convex, least width $3\frac{1}{2}$ in head and about equal to length of snout. Cleft of mouth extending to beyond middle of eye; lower jaw included. Teeth uniserial; those of upper jaw all canines, the first three on each side small, but becoming larger outwards, next three or four much larger, rest smaller than those in front; anterior teeth of lower jaw entire incisors, which have on each side about six large graduated canines and behind these a few smaller ones; teeth of lower jaw slightly oblique. Distance from front of dorsal to root of caudal about $2\frac{5}{6}$ in body ($3\frac{1}{2}$ in total). Pectorals moderate, 2 in head; ventral disk $1\frac{1}{4}$ in head.

Color.—Olivaceous, without any distinct bands; the occipital region and the caudal peduncle darker; body irregularly mottled with groups of darker spots; nape, preopercle, cheeks, and snout with numerous dark points; indistinct dark lines radiating from eye. Lips dark. Fins dusky; dorsal and anal with the first two rays black; a pale spot near base of caudal; axil of pectoral dusky.

A single specimen taken.

34. Platophrys lunatus (Linnæus).

35. Achirus inscriptus (Gosse).

36. Antennarius tigris Poey.

Chironectes tigris Poey, Memorias, I, 217, tab. 17, fig. 2, 1860.

Antennarius tigris Poey, Synopsis, 405, 1868.

In the collection is a specimen about four inches long, which agrees perfectly with Poey's figure of *A. tigris*.

37. Balistes vetula Linnæus.

38. Orbidus testudineus (Linnæus.)

One specimen $7\frac{1}{2}$ inches long, ground-color very light; spots on sides not larger than those on back, which are smaller than pupil of eye.

INDIANA UNIVERSITY, *June* 28, 1889.

DESCRIPTION OF A NEW SPECIES OF BATHYMASTER (B. Jordani) FROM PUGET'S SOUND AND ALASKA.

BY CHARLES H. GILBERT.

Bathymaster jordani sp. nov. 26641, 27265, 32404.

Bathymaster signatus Jordan and Gilbert, Proc. U. S. Nat. Mus., 1881, pp. 9, 52; Synopsis Fish. N. A. 623. Not of Cope.

On making a recomparison of the specimens of *Bathymaster* in the U. S. National Museum I have ascertained that those from Puget's Sound, together with a single specimen from Fort Wrangel, Alaska, belong to a species very distinct from the common *B. signatus* of northern Alaska. It may be thus characterized:

Body more elongate, depth $6\frac{1}{2}$ in length ($5\frac{1}{2}$ in *signatus*); mouth smaller, maxillary reaching vertical from middle of eye, $2\frac{1}{5}$ in head ($2\frac{1}{4}$ in *signatus*); cheeks and upper anterior part of opercles, closely invested with fine scales (in *signatus*, head entirely naked); lateral line running on a series of enlarged scales, the exposed surfaces of which are fully three times that of other scales of body (scales of lateral line not conspicuously enlarged in *signatus*); scales appearing much smaller, about nine in a series upwards and backwards from middle of lateral line to base of dorsal. Fins higher in the male, the longest dorsal ray two-thirds length of head; the membranes from last dorsal and anal rays reach to or almost to base of caudal (the caudal peduncle more largely free in *signatus*). Colors brilliant (see Synopsis, p. 623); in *signatus*, color an almost uniform warm brown, the fins somewhat mottled with yellowish.

In both species of *Bathymaster* I find the anterior dorsal rays all articulated; in *signatus* all but the first two or three are distinctly branched, in *jordani* the anterior half or two-thirds of the fin consists of simple rays, the posterior ones only being evidently branched.

WASHINGTON, D. C., *August* 27, 1889.

NOTES ON A COLLECTION OF FISHES OBTAINED IN THE GILA RIVER, AT FORT THOMAS, ARIZONA, BY LIEUT. W. L. CARPENTER, U. S. ARMY.

BY PHILIP H. KIRSCH.

The following is a list of the fishes collected by Lieut. W. L. Carpenter, U. S. Army, at Fort Thomas, on the Gila River, Arizona Territory, and sent by him to the museum of the University of Indiana, June 4, 1887.

Lieutenant Carpenter has sent with them a number of notes on the habits and local names of the fishes. It is his opinion that there are but these seven species found in the Gila River, at Fort Thomas, and that several of the species described from that stream are not really distinct. He states further, that *Gila emorii* and *Ptychochilus lucius* present varying characteristics with different stages of growth. These may have been taken for many species.

1. **Catostomus latipinnis** Baird & Girard.

One specimen, 19 inches long. This specimen agrees with the description of Jordan & Gilbert in the Synopsis of the Fishes of North America, except in having a longer preorbital bone, this being more than twice as long as deep. The dorsal is not deeply incised, its height not equal to length of head.

2. **Catostomus gila** Kirsch, sp. nov.

Three specimens, 12 to 14 inches long. This species is closely allied to *C. ardens* Jordan & Gilbert, but differs from it in having the body more compressed, the antedorsal region much less elevated, and not so full, the caudal peduncle shorter and more compressed, and the least depth in length $1\frac{3}{4}$. The dorsal is shorter and higher, its longest ray nearly twice the length of last, and longer than the base of fin, the free margin incised, the ventrals being longer and more pointed. Head subconic, preorbital broad, twice as long as wide; snout $2\frac{1}{4}$ in head; eye small, $6\frac{1}{2}$ in head, 3 in snout, and 3 in interorbital space; lips rather large, the upper with about 4 rows of papillæ, the lower divided by a narrow fissure, to near its base, into two fleshy lobes, each with about 6 rows of papillæ, the lobes about length of eye.

Dorsal short and high, its 4th ray midway between tip of snout and base of caudal fin on lateral line, the last ray little more than half the length of first; base of fin $1\frac{1}{4}$ in longest ray and $1\frac{1}{2}$ in head. Anal short and high reaching to base of caudal fin, its base 2 in that of dorsal, its longest ray (3d) slightly longer than that of dorsal. Caudal large, expanded, forked about $\frac{1}{3}$ of its median rays, width at origin $1\frac{1}{3}$ in base of dorsal; lower lobe the longer, its longest ray about equal that of dorsal.

Ventrals small, anterior insertion opposite middle of dorsal, their longes ray (3d) but slightly shorter than that of dorsal. Pectorals narrow bu long, reaching to front of pubic bones, their longest ray (4th) longe than that of dorsal and equal to that of ventral. Scales large, longe than deep, smaller anteriorly and crowded, largest on peduncle of tail and smallest on breast.

Color (alcoholic): above, and sides to axils of pectorals, dark brown the scales being dark at base and covered with dark punctulations below yellow; the fin membranes dark. Lateral line abruptly decurvec near its origin, then running on median line of body to caudal fin Head 4½ in body; depth 4½; D. 11 to 12; A. 7; scales 11—58 to 60—10 One of the typical examples has been sent to the U. S. National Museum.

3. **Catostomus insignis** Baird & Girard.

One specimen, 12½ inches long. Scales on sides of moderate size, larger anteriorly than posteriorly, but so covered that the contrary seems to be true; the anterior scales are of a circular outline, the posterior nearly twice as long as deep. Those on the back very large, those on the belly very small, only about half as large as the former.

4. **Catostomus Clarki** Baird & Girard.

One specimen, 12 inches long. The scales on back not quite so large as those of *C. insignis*, but otherwise similar in size and arrangement to those of that species. Scales on lateral line 68.

5. **Xyrauchen* cypho** (Lockington).—Buffalo Fish.

This species, *Catostomus cypho* Lockington, seems to be the type of a distinct genus, *Xyrauchen* Eigenmann & Kirsch, gen. nov.

The genus *Xyrauchen* agrees with the genus *Catostomus*, except in having behind the occiput a very large sharp-edged hump formed by the singularly developed anterior interneurals.

The anterior portion of the hump is supported by a large interneural formed by a thick central pillar with anterior and posterior wings, the former coming to a point on the medial projecting plate of the supraoccipital, forming a large opening beneath it; the latter wing is somewhat smaller and articulates with the second interneural. The upper margin of the first interneural is highest at the point of the central pillar, from which it slopes anteriorly and posteriorly. "The base of the central pillar is expanded transversely, giving a double articulating surface on its under side" (Lockington). The next interneural is a thin, flat, sub-rectangular plate; the third is an irregular flat plate about half as large as the second, while the next three are small flat plates above and bent forward.

The interneurals of the dorsal fin with a central ray and an anterior and posterior expansion, which does not, however, extend to their lower

---

* Ξυρός, razor; *αὐχήν*, nape.

ends. The one supporting the first two rays is formed by two interneural bones united by a thin bony plate, which forms no expansion in front of the first and but a narrow one behind the second. Upon the first vertebra is a broad, irregular surface for the reception of the first interneural bone. "The transverse processes of the first vertebra are broadly expanded inferiorly, and their lower edges united by a suture to a pair of large bony plates of complex form, connecting the air-bladder with the back of the skull." (Lockington.) From the anterior margin of each neurapophysis of the next eight or nine vertebræ, and resting upon the zygopophysis of the preceding vertebra, spring processes which are directed upward and forward; these in the first three vertebræ form arches surmounted by spines which are about half as long as the interneural spine. These processes diminish in size on each successive vertebra.

The following is a description of the species. Body stout, elongated, compressed posteriorly, anterior outline in a slightly convex line from tip of snout to occiput, where commences a prominent hump, which reaches its greatest height at a distance from the occiput about equal to the length of the snout, and thence descends in a straight line. Ventral outline from mouth to anal fin almost straight. Head small, elongate, conical, top of head $2\frac{1}{2}$ times in distance (in a straight line) from tip of snout to front of dorsal; snout $2\frac{1}{2}$ in head; eye small, 3 in snout, $7\frac{1}{4}$ in head; width of preorbital 3 in its length; mouth rather wide, inferior; upper lip with two rows of papillæ, lower lip rather small, in two distinct fleshy ovoid lobes, with about eight rows of low, flat-topped papillæ; width of opercle about 3 in head; distance from posterior margin of eye to posterior margin of opercle equals distance from center of eye to tip of snout; posterior margins of opercle and subopercle form a continuous, bold, convex curve.

Dorsal low and long, its margin incised, third ray midway between tip of snout and base of caudal fin on lateral line, its base $1\frac{1}{3}$ in length of head, second ray longest, which is $1\frac{1}{3}$ in its base and twice length of last ray. Ventrals falcate, anterior insertion opposite middle of dorsal, reaching to within $\frac{1}{2}$ of their length of the vent; their longest ray (3d) about 2 in head, and twice length of last. Anal short and reaching to rudimentary rays of caudal, its longest ray contained $1\frac{1}{2}$ in head. Caudal broad and strong, forked about $\frac{1}{2}$ its length; caudal peduncle stout, compressed, widening considerably toward the caudal base, least depth $2\frac{1}{3}$ in its length, measured on lateral line; longest ray about $1\frac{1}{7}$ in head; rudimentary rays well developed. Pectorals lanceolate, placed low, reaching to near front of pubic bones, their longest ray equal to that of dorsal. Scales cycloid, variable in size, longer than high, scarcely imbricated. Largest scales of body upon the peduncle of the tail, being almost twice as long as high. Ridge of dorsal hump without scales. Lateral line decurved near its origin, then running on the median line of the body to the caudal fin.

"Color (December) dark brown with a brassy reflection, yellow below. Iris brown, reddish tinted. Pharyngeal teeth in a single row small, numerous, over 35." (Carpenter.) Peritoneum black; intestine simple, 5½ times length of body. Head 4 in body; depth 4; D. 13; A. 7; scales 17–77–12.

6. **Ptychochilus lucius** Girard.—Gila Salmon.

One specimen, 15 inches long. It agrees in general with Jordan & Gilbert in Synopsis Fishes North America. "Peritoneum silvery; vertebræ 45 to 46." (Carpenter.)

7. **Gila emorii** Baird & Girard.—Gila Trout; Bony Tail.

Six specimens ranging from 8 to 14 inches in length. They agree with the description of Jordan & Gilbert in Synopsis Fishes North America, except in the following characteristics: In the greater number of specimens the maxillary does not reach to the front of the orbit; the pectorals not quite reaching to front of pubic bones; front of dorsal about equal to distance between tip of snout and base of caudal fin measured on the lateral line; least depth of caudal peduncle 4 in its length.

"Color (October), back dark, sides light, belly bright silvery; dorsal darker, caudal brown; iris pink tinted. Peritoneum dusky. Pharyngeal bone falciform, with several foraminæ inferiorly. Teeth, pharyngeal, falcate, compressed, with grinding surface, usually but two or three of the large teeth worn; 2, 5–4, 3, sometimes 2, 5–4, 2. Vertebræ 42 to 45. Scales 26–87 to 90–21. Large specimens in November show but slight grinding surface. The food of this species consists almost entirely of *Gasteropods* and *caddis-worms*, which they crush with their powerful pharyngeals. As they do not feed much during winter, the grinding surface is almost obliterated at that season through disuse; the species might thus have been described as without grinding surface.

"The young differ greatly from the old; the cranium probably not becoming depressed until the second year. A specimen found 4 inches in length with the cranium not perceptibly depressed, and the eye 4 in head. In spring the iris is reddish. They are very tenacious of life. They have revived after being several hours out of the water and having become perfectly dry and stiff. They take the hook freely." (Carpenter.)

INDIANA UNIVERSITY, *April* 16, 1889.

NOTES ON SOME NEOTROPICAL BIRDS BELONGING TO THE UNITED STATES NATIONAL MUSEUM.

R.

BY HANS VON BERLEPSCH.

The authorities of the United States National Museum having, with their usual kindness, sent me for examination, at my request, several obscure specimens belonging to that establishment which I was anxious to see, I have studied them carefully, and now wish to offer some notes thereon. To the Secretary of the Smithsonian Institution and the Director of the National Museum my best thanks are due for thus facilitating my work.

I begin by offering some notes on the Humming-birds which are included in the lot.

1. Phaëthornis superciliosus (LINN.) *ex* Bahia = *Ph. pretrei* (LESS. & DEL.).
No. 44976. Bahia *ex* Lawrence.

This specimen is by no means = *Ph. superciliosus* (L.) *apud* ELLIOT, but proves to be a Bahia skin of *Ph. pretrei* (LESS. & DEL.) in much faded plumage. *Ph. pretrei* of Lesson and Delattre was once believed by Messrs. Cabanis and Heine to be true *superciliosus* LIN. (*ex* BRISSON), and Mr. J. Gould, when writing his monograph, unfortunately accepted this identification. More recently Messrs. Salvin and Elliot have shown that true *superciliosus* of Linnæus is the same as *Ph. fraterculus* GOULD and *Ph. consobrinus* "BOURC." REICHB. or *Ph. moorei* LAWR. While I agree perfectly with the last-named authors in placing these names among the synonyms of *Ph. superciliosus*, I nevertheless regard the *Ph. malaris* NORDM. to be quite a distinct species, occurring in Cayenne along with *Ph. superciliosus*, from which it is distinguishable by its much superior size and other points of difference. I believe *Ph. malaris* to be restricted to Cayenne. The types, belonging to the Berlin Museum, which I have examined, are said to be from Brazil (through Gello and Olfers), but this statement is probably erroneous.*

2. Phaëthornis longirostris (LESS.) *ex* Pebas = *Ph. superciliosus* (L.).
No. 55374, male Pebas, Peru (*ex* Williams College).

In his catalogue of Trochilidæ in the collection of the U. S. National Museum (Proc. U. S. Nat. Mus., 1880, p. 309, note,) Mr. Ridgway says

* In the Museum Heineanum, at Halberstadt, there are likewise three specimens of *Ph. malaris*, believed to be from Brazil, but no authority stating the correctness of this habitat is to be found on the labels. As far as I can make out from the mode of preparation in these stuffed specimens, they appear to have been once genuine Cayenne skins, showing their tails dried in the form of a fan, which I have observed in all the skins of Humming-birds which are sent from that country. I possess three undoubted Cayenne skins of *Ph. malaris* in my collection. It is the "Brin-blanc" of Audebert and Vieillot, etc. (H. v. B.)

that this specimen "is not distinguishable from northern specimens o *Ph. longirostris.*" I, however, find that the skin in question belongs to true *Ph. superciliosus* (L.) *apud* ELLIOT, agreeing perfectly with other specimens from Upper Amazonia and British Guiana. Mr. Ridgway may have compared it with his *Ph. superciliosus* from Bahia, which is = *pretrei.* I may remark that *Ph. superciliosus* is easily distinguishable from *Ph. longirostris* in having the upper tail-coverts green, tipped with pale fulvous, while in *longirostris* they are deep fulvous, barred with 2 to 3 dark (greenish) bands.

3. **Phaëthornis longirostris** (LESS.) *ex* Turbo; name correct
No. 17918, male, Turbo (coll. Schott), type of *Ph. cassini* LAWR.

This is evidently a young bird presenting many signs of immaturity. Unfortunately it is a bad and imperfect skin, and in consequence of this it is difficult to make a close comparison with specimens of *Ph. longirostris* from Central America. I may, however, note that in the Turbo bird the upper tail-coverts are of a deeper tint, being more brownish fulvous. The back is dark brown, with slight bronze reflections, instead of being green. The stripe in the middle of upper throat and the mystacal stripe are of a deeper fulvous. The under parts are generally darker and more mixed with grayish brown.

4. **Phaëthornis squalidus** (TEM.) *ex* Rio Negro; name correct, locality incorrect.
No. 24534, Rio Negro (*ex* Dr. HEERMANN).

The skin of this bird is of the peculiar make by which all skins of trade coming from Southern Brazil are recognizable *primo visu.* If Rio Negro means the northern confluent of the Amazon the locality is evidently erroneous, but there is a river "Rio Negro" on the northern frontier of Sta. Catarina where the skin may have really come from.

5. **Phaëthornis adolphi** GOULD *ex* Turbo = *Ph. striigularis* GLD.
No. 17915, female, Turbo (coll. Michler).

This is by no means *Ph. adolphi*, but *Ph. striigularis* GLD., agreeing with specimens of that species from Bogota and Porto Cabello.

6. **Campylopterus lazulus** (VIEILL.) *ex* Peru; name correct, locality erroneous.
No. 11744, male, Peru (C. Raymond).

This species has not yet been stated to occur in Peru, and the locality attributed to the specimen is most probably erroneous. The skin looks like a Bogota skin, and agrees with others from that locality.

7. **Lafresnaya flavicaudata** (FRAS.) *ex* Popayan; name correct, locality erroneous.
No. 24565, male, Popayan (Dr. Heermann).

This species has not yet been mentioned from Popayan, where, however, *L. saulæ* (BOURC. & DEL.) has been stated to occur. I believe the specimen in question to be simply a so-called Bogota skin. It does not differ from specimens sent from that region. The species ought to be called *L. lafresnayei* (BOISS.), or, as I prefer, *Entima lafresnayei* (BOISS.).

8. **Florisuga mellivora** (L.) *ex* Tres Marias; name correct, locality erroneous.
No. 25851, male, Tres Marias Islands, July, 1861 (John Xantus).

As in the case of other specimens of Humming-birds forwarded by J. Xantus and labeled as having been collected in the Tres Marias Islands, I believe this locality to be clearly erroneous. The specimen of *F. mellivora* in question is apparently of the same make as the skin of *Uranomitra guatemalensis*, also said to be from Tres Marias. Both skins may have really come from Guatemala. The *Florisuga* specimen is a young male in imperfect plumage.

9. **Helianthea lutetiæ** (DEL. & BOURC.) *ex* Popayan; correct.
No. 29277, male, Popayan (D. G. Elliot).

This bird agrees with specimens from Quito in Museum. H. v. B.

10. **Thalurania glaucopis** (GML.) *ex* Tres Marias; name correct, locality erroneous.
No. 25851, female, Tres Marias Islands, July, 1861 (John Xantus). Type of *Th. luciæ*, LAWR.

I quite agree with the opinion expressed by Messrs. Elliot and Ridgway, viz, that the bird in question belongs to *Th. glaucopis* (GML.), male juvenile, the locality, Tres Marias, being no doubt erroneous. The skin is of the unmistakable make of all Rio skins, which are sent in large numbers annually to the great markets of Europe. The yellow spot on the under mandible, mentioned by Mr. Lawrence as the chief distinguishing character of his *Th. luciæ*, only presents itself on one side of the under mandible and is simply the result of an injury, the rhamphotheca on that part having been rubbed away.

11. **Thalurania eriphile** (LESS.) *ex* Rio Grande do Sul; name correct, locality probably erroneous.
No. 68314, male, Rio Grande do Sul (Albuquerque).

Agrees with a specimen from Bahia in Museum H. v. B. I much doubt the correctness of the habitat Rio Grande do Sul, this species not having been stated to occur so far south.

12. **Cephalolepis delalandi** (VIEILL.) *ex* Rio Grande do Sul; name correct, locality probably erroneous.
No. 68313, male, Rio Grande do Sul (Albuquerque).

This is true *C. delalandi*, agreeing with specimens from Rio de Janeiro. The locality, Rio Grande do Sul, has not yet been mentioned for this species, and I do not believe it occurs there, as that province is the home of *C. loddigesi*.

13. **Aglæactis caumatonota** (GOULD) *ex* Peru; correct.
No. 39931, Matara Ayacucho, October 22, 1864 (Walter S. Church). Type of *A. olivaceocauda* LAWR.

This specimen appears not to be different from true *A. caumatonota* GLD., the type of which came likewise from Peru.

14. **Uranomitra quadricolor** (VIEILL.) *ex* Mazatlan—not of Vieillot=*U. ellioti* BERL.
No. 115288. Mazatlan in summer.

This is evidently the species named *U. quadricolor* by Mr. D. G. Elliot, but it is not the *quadricolor* of Vieillot, which I believe to be the

 Sept. 25, 1889.

same as the bird which we used to call *U. cyanocephala*. In his description of *Trochilus quadricolor*, Vieillot says, "un beau vert brille sur les flancs," which is by no means the case in *U. quadricolor* of Elliot, but applies well to *U. cyanocephala* auct. Therefore it becomes necessary to bestow a new name upon the species named *U. quadricolor* by Mr. Elliot, and I propose to call it in future *U. ellioti* BERL. I believe the locality, Mazatlan, has not been mentioned elsewhere for this species.

15. Uranomitra quadricolor (VIEILL.) juv. fere pull. *ex* Orizaba = *Sphenoproctus curvipennis* (LICHT.)

No. 38224 (juv. fere pull.) Orizaba (Botteri).

This is by no means an *Uranomitra*, but a very young bird of *Sphenoproctus curvipennis*, which is evident from the long yellowish legs and claws, as well as from the structure of the wings and the blackish tail-feathers, also the grass green color of the back, etc.

16. Uranomitra viridifrons Elliot; correct.

No. 57774, male, Tehuantepec, Sta. Efigenia, 22d December, 1868 (Prof. F. Sumichrast).

This species, which agrees with *U. violiceps* in the coppery hue on the tail-feathers, I had never seen before. The locality, Tehuantepec, is interesting as showing that *U. viridifrons* occurs in a locality where *U. violiceps* is also found. I confess I am not quite convinced that these forms are really distinct specifically.

17. Uranomitra guatemalensis Gould *ex* Tres Marias; name correct, locality erroneous.

No. 25855, female, Tres Marias, July, 1861 (Xantus).

Agrees with specimens from Guatemala. The locality, Tres Marias, is doubtless erroneous. See remarks under the head of *Florisuga mellivora*, etc.

18. Agyrtria tephrocephala (VIEILL.) *ex* Surinam = *A. viridissima* (LESS.).

No. 70577, Surinam (C. F. Hering).

This is by no means = *A. tephrocephala* (VIEILL.), which is a much larger bird with uniform pure white under tail coverts, and is exclusively found in Southern Brazil. The Surinam bird belongs to the species sometimes called *A. linnæi*, or more recently by Mr. D. G. Elliott *A. tobaci* (GML.). I, however, believe it entitled to the name of *A. viridissima* (LESS.), the *Trochilus tobaci* of Gmelin being most probably the same as *Pyrrhophæna erythronota*.

19. Amazilia cyanura GOULD *ex* Retaleulen, Guatemala; correct.

No. 33654, Guatemala, Retaleulen, Pacific coast, September, 1862 (O. Salvin).

This is an excellent species which I had not seen before, it being somewhat rare in collections. It comes nearest to *A. devillei sive mariæ* (BOURC.), but is easily distinguishable by its steel-blue tail, bluish instead of rufous under tail coverts, and the greater restriction of the cinnamon color on the base of the secondaries. The green of the body above and

beneath is of a darker hue and of a more bluish cast, and this color extends over the middle of the back, which in *A. devillei* is of the same coppery bronze as the lower back.

—**20. Juliamyia typica** Bp. *ex* Turbo = *Damophila juliæ* (Bourc.).
No. 17902, male, Turbo (Schott).

The Turbo bird belongs to the race with a glittering brilliant crown, viz, true *D. juliæ* (Bourc.), of which *J. typica* Bp. and *J. feliciana* Less. are synonyms, and not to the form with a dull colored crown inhabiting Panama, which I have named *D. panamensis* (*cf.* Journ. für Orn., 1884, p. 312).

21. Hylocharis sapphirina (Gml.) *ex* Rio Grande do Sul; name correct, locality probably incorrect.
No. 68312, male, Rio Grande do Sul (Albuquerque).

Agrees with specimens from Rio de Janeiro and Bahia. I much doubt the correctness of the habitat Rio Grande do Sul, the species not having been mentioned from there elsewhere.

22. Hylocharis cyanea (Vieill.) *ex* Rio Grande do Sul; name correct, locality probably erroneous.
No. 68315, male, Rio Grande do Sul (Albuquerque).

As in the case of *H. sapphirina*, I doubt the correctness of the habitat. The specimen agrees with others from Rio de Janeiro and Bahia.

—**23. Cyanophaia cœruleigularis** (Gould) *ex* Cartagena = *C. luminosa* (Lawr.) ad.
No. 17912, Cartagena (A. Schott).

This is by no means *C. cœruleigularis* (Gld.), but belongs to *C. luminosa*, agreeing perfectly with specimen No. 17911 (named *luminosa*) in size and general coloration. The blue on the throat appearing here and there I regard to be simply the result of an abrasion of the feathers. In fact the bird is in much worn plumage.

—**24. Cyanophaia luminosa** (Lawr.) *ex* Cartagena—correct.
No. 17911, Cartagena (A. Schott).

Beyond the differences stated by Mr. George N. Lawrence to exist between this species and *S. goudoti* I may note that in *C. luminosa* the upper part of the head is of a much darker and a quite dull green of a bluish cast (being somewhat luminous green in *C. goudoti*), and that it has a much shorter bill.

25. Chlorostilbon pucherani (Bourc. & Muls.) *ex* Rio Grande do Sul: name correct, locality erroneous.
No. 68310, male, Rio Grande do Sul (Albuquerque).

This is true *Chl. pucherani*, agreeing with specimens from Rio de Janeiro in my collection. In Rio Grande do Sul *Chl. pucherani* is replaced by *Chl. splendidus egregius* Heine, which has a much longer bill. It follows that the locality given by Albuquerque must be erroneous, and in fact his specimen is of the unmistakable make of all the skins imported from Rio de Janeiro.

26. Chlorostilbon pucherani (BOURC. & MULS.) *ex* Tres Marias; name correct, locality erroneous.

No. 25856, Tres Marias Islands, July, 1861 (John Xantus). Type of *Ch. insularis* LAWR.

This specimen is certainly referable to *Chl. pucherani*, as already pointed out by Messrs. Elliot and Ridgway. It is a young male in not quite mature plumage. The make-up of the skin is that of all the skins received from Rio de Janeiro, and the habitat, Tres Marias Islands, is no doubt erroneous.

27. Chlorostilbon angustipennis (FRAS.) female, *ex* Cartago = *Chl. salvini* (CAB. & HEINE). ?

No. 42986, female, Cartago, January, 1866 (J. Cooper).

I am not quite sure if this is really a female of *Chl. assimilis* LAWR., united by Mr. Elliot (incorrectly as I believe) with his "*angustipennis*" (not of Fraser). Before having seen an adult male of *Chl. assimilis* from Costa Rica I am rather inclined to believe the female from Cartago to be referable to *Chl. salvini* (CAB. & HEINE). It has a uniformly black upper mandible, but the basal half of the under mandible is flesh-colored, while it is uniformly black in the male of *Chl. assimilis.*

28. Chlorostilbon angustipennis (FRAS.) male, juvenile, *ex* Pebas = *Chl. daphn* "BOURC." GOULD.

No. 55382, male, Pebas, Peru (Orton).

This is not *angustipennis* of Elliot, nor of Fraser, but belongs to the section of *Chlorostilbon* with a square tail, of which *Chl. prasinus* is the type. I believe the young male from Pebas entitled to the name of *Chl. daphne* "BOURC." GOULD, of which *Chl. peruanus* GOULD is probably a synonym.

The following notes relate to some other types of birds of different families belonging to the U. S. National Museum, which were kindly sent to me for examination in 1886:

1. Campylorhynchus brevipennis LAWR. = *C. nuchalis* CAB. juvenile.!

No. 109509, Venezuela, Krider; type of *C. brevipennis* LAWR., Ann. Lyc. N. H., New York, VIII (1866), page 344.

This is certainly a very young bird of *C. nuchalis* CAB. I got a similar specimen from Puerto Cabello, which is in more advanced plumage, but presents still all the peculiarities of coloration which induced Mr. Lawrence to institute a new species. I possess also young birds of *C. pardus* BP. from Baranquilla, and of *C. brevirostris* LAFR. from Bogota, which are in a similar stage of plumage.

2. Saltator fulviventris LAWR. = *S. cœrulescens* VIEILL., juvenile.

No. 54261, Paraguay, 3–49, No. 3. Eyes dark; legs dark. U. S. steamer *Water Witch*, Capt. T. J. Page, U. S. Navy. Type of *S. fulviventris* LAWR., Ann. Lyc. N. H., New York, VIII (1864), p. 41.

This is evidently an immature bird in transition plumage, and I have not the slightest doubt that it is the young of *S. cœrulescens* VIEILL.

S. fulviventris Lawr. has not been mentioned in Mr. Sclater's Catalogue of the Tanagridæ (Vol. XI of Catalogue British Museum).

3. **Philydor rufobrunneus** Lawr.=*bona species, potius Automolus.!*

No. 34770, male, Barranca, Costa Rica, 18th April, 1864, J. Carmiol; type of *Ph. rufobrunneus* Lawr. Ann. Lyc. N. H., New York, VIII (1865), p. 127.

Apparently an excellent species which seems to have its nearest ally in *Automolus rubiginosus* Scl. It is certainly not a *Philydor*. The type, as far as I know, remains still unique. From *A. rubiginosus* it may be distinguished by the following diagnosis:

Ph. rubiginoso affinis, sed coloribus multo dilutioribus, capite supra obscure olivaceo-brunneo (nec rufobrunneo), capitis lateribus ochraceo variegatis. Gula dilutiore ochraceo plumis gulæ inferioris lateraliter fusco marginatis, pectore olivaceo tincto pallide ochraceo striato. Abdomine brunnescentiore. Dorso uropygio, alis caudaque necnon tectricibus subcaudalibus pallidioribus. Alis caudaque longioribus, rostro vero multo breviore, mandibula fere omnino fusca distinguendus. Al. 94, caud. 92, mandibula $13\frac{3}{4}$, tars. $26\frac{3}{4}$ mm.

4. **Philydor virgatus** Lawr.=*bona species, potius Automolus.*

No. 42959, Angostura, Costa Rica, Oct. 7, 18,66, length, $7\frac{1}{4}$; extent, 9. Iris brown. J. Carmiol; type of *Philydor virgatus* Lawr., Ann. Lyc. N. H., New York, VIII (1867), p. 468.

This may be a valid species but not of the genus *Philydor*, as I think. In fact, it seems to be a close ally of *Automolus subulatus* (Spix) *ex* Amazonia, from which it may be distinguished by the following points of difference: Bill longer and somewhat stronger, the upper mandible darker in color. The ground color of the top of the head more blackish. The ochraceous stripes there and still more on the hind neck on the upper back are much more pronounced. The ground color everywhere on the upper parts darker or more blackish. The under parts of the body are rather lighter in color. Throat and breast of a clearer ochraceous. Wings and tail somewhat longer. (Al. $84\frac{1}{2}$, caud. 72, culm. $23\frac{3}{4}$, tars. $20\frac{1}{2}$mm.)

5. **Automolus rufescens** Lawr.=*Philydor panerythrus* Scl.

No. 39065, Costa Rica (Birris), female, 194, May 15, 1865; iris black; length $7\frac{1}{2}$; José C. Zeledon; type of *A. rufescens* Lawr. Ann. Lyc. N. H., New York, VIII (1866), p. 345.

I have had no typical specimens of *Ph. panerythrus* Scl. from Colombia for comparison, but a specimen from Veragua in my collection agrees very well with the type of *A. rufescens* Lawr. The latter is but a little paler and has somewhat shorter wings; al. $95\frac{1}{2}$, caud. 86, culm. $19\frac{1}{4}$, tars. $22\frac{3}{4}$mm. Mr. O. Salvin, in Ibis, 1870, p. 110, has already stated the absolute identity of Lawrence's type with Sclate's type of *Ph. panerythrus*.

6. **Anabazenops lineatus** Lawr. should stand as *A. subalaris lineatus* (Lawr.).

No. 34766, Angostura, Costa Rica, female, 21, April, 1864; J. Carmiol. Type of *A. lineatus* Lawr. Ann. Lyc. N. H., New York, VIII (1865), p. 127.

In the Ibis, 1870, p. 110, Mr. O. Salvin declared that the type of *A. lineatus* Lawr. differed in no way from the types of *A. subalaris* Scl. from

Ecuador. Having compared the above type with another skin from Costa Rica in my collection and specimens from Western Ecuador (true *subalaris*), I have found several slight though apparently constant points of difference which induce me to regard *A. lineatus* as a northern form or subspecies of *A. subalaris*, from which it may be distinguished by the following diagnosis:

+ *A. subalaris lineatus* (LAWR.).

A. subalari simillimus, sed major, rostro imprimis longiore, differt etiam corpore supra saturatius rufo-brunneo (in subalari magis olivaceo-brunneo), dorso obsoletius striato, striis in dorso medio evanescentibus. Corpore subtus paulo rufescentiore, gula purius stramineo (in subalari magis ochraceo) flava. Subalaribus intensius rufo cinnamomeis.

Specimens.	Al.	Caud.	Culm.	Tars.
A. subalaris SCL.:				*Mm.*
1. Male, Cayandeled, Western Ecuador, March 16, 1883	$86\frac{1}{2}$	75	$19\frac{1}{2}$	$22\frac{1}{2}$
2. Male, Cayandeled, Western Ecuador, February 13, 1883	89	72	$19\frac{1}{4}$	$23\frac{1}{2}$
3. Male, Cayandeled, Western Ecuador, February 1, 1883	82	72	$19\frac{1}{4}$	$22\frac{3}{4}$
4. Male, Pedregal (2,800′), Western Ecuador, February 14, 1883	85	74	18	22
5. Female, Chaquarpata (5,700′) Western Ecuador, March 5, 1883	$85\frac{1}{2}$	72	$19\frac{1}{4}$	$21\frac{1}{2}$
A. subalaris lineatus LAWR.:				
1. Female, Angostura, Costa Rica, April 21, 1864 (type)	87	79	$20\frac{3}{4}$	$22\frac{1}{2}$
2. Adult, Costa Rica, Mus. H. v. B.	96	87	$21\frac{1}{5}$	$23\frac{1}{2}$

MUENDEN, *May*, 1889.

ON THE CLASSIFICATION OF THE MAIL-CHEEKED FISHES.

BY THEODORE GILL.

In the northern seas are found fishes known as Sculpins, Pogges, and Gurnards. In the Systema Naturæ, Linnæus referred the Sculpins and Pogges to the genus (160) *Cottus*, whose essential character was a head broader than the body, while the Gurnards were segregated in the genus (172) *Trigla*, distinguished by free finger-like rays below the pectorals. In the Mediterranean and warmer seas live compressed scaly fishes more or less beset with tag-like cutaneous appendages; these were combined in the genus (61) *Scorpæna*, whose chief characteristic was a head with scattered cirri or tags (*caput scirrhis adspersum.*) In the northern seas is also found a species now known to be related to the *Scorpæna*, but which was referred by Linnæus to the genus *Perca* as *P. marina*. Such fishes are the subjects for present inquiry.

CUVIER.

In 1829, in the Règne Animal and the Histoire Naturelle des Poissons, Cuvier established, as the second family of Acanthopterygian fishes,* those with mailed cheeks, "Joues cuirassées." This family was intended to embrace a number of fishes to which the singular shape of the head, beset with spines and armed and cuirassed, gives a peculiar physiognomy which has always caused them to be classified in special genera, although they have intimate relations with the perches. Their common character is to have suborbitals more or less extended over the cheek and articulating behind with the preoperculum. *Uranoscopus* alone, according to Cuvier (which he referred to the family of perches), has something approximating it, but its suborbital, although very large, is attached behind to the temporal (prootic) bone, and not to the preoperculum. To the family thus defined he referred the genera *Trigla*, *Cottus*, and *Scorpæna* of Linnæus, as well as some of the Linnæan *Gasterostei*.†

* Cuvier gave no Latin name to the "Joues cuirassées," and the defect has been attempted to be remedied by the proposal of various terms involving the idea, *e. g.*, *Buccæ loricatæ* (McMurtrie, 1831), *Loricati* (Jenyns, 1835), *Parcioplonidæ* and *Parcioplitæ* (Richardson, 1836), *Canthileptes* (Swainson, 1838), *Cataphracti* (Müller, 1843), *Sclero-parei* (Gravenhorst, 1845), *Sclerogenidæ* (Owen, 1846), and *Cataphractoidæ* (Cantor, 1850.

† La deuxième famille des Acanthoptérigiens, celle DES JOUES CUIRASSÉES, contient une nombreuse suite de poissons auxquels l'aspect singulier de leur tête, diversement hérissée et cuirassée, donne une physionomie propre qui les a toujours fait classer dans des genres spéciaux, bien qu'ils aient de grands rapports avec les perches. Leur caractère commun est d'avoir les sous-orbitaires plus ou moins étendus sur la joue, et s'articulant en arrière avec le préopercule. L'Uranoscope seul, dans la famille précédente, a quelque chose d'approchant; mais son sous-orbitaire, bien que très large, s'attache en arrière aux os de la tempe, et non pas au préopercule.

Linnæus en faisait trois genres: les *Trigles*, les *Cottes*, les *Scorpènes*; mais on a dû les subdiviser, et il faut y joindre une partie de ses Gasterostées.

The Linnæan genera, subdivided, and additional genera subsequently discovered, follow:

Joues cuirassées.

Trigles.	
Trigles proprement dits.	Trigla
Prionotes.	Prionotus
Malarmats.	Peristedion §
Dactyloptères.	Dactylopterus §
Cephalacanthes.	Cephalacanthus §
Cottus.	
Cottus proprement dits.	Cottus
Aspidophores.	Hemitripterus
Aspidophoroides.	Bembras
Hemitriptères.	Aspidophorus §
Hemilepidotes.	Platycephalus §
Platycephales.	Hemilepidotus
Scorpènes.	Blepsias
Scorpènes proprement dites.	Apistes
Tænianotes.	Scorpæna
Sebastes.	Sebastes §
Pterois.	Pterois §
Blepsias.	Agriopus §
Apistes.	
Agriopes.	
Pelors.	
Synancées.	Pelor §
	Synanceia §
Lepisacanthes.	
Epinoches.	Monocentris.
Epinoches proprement dites.	Gasterosteus.
Gastrés.	
Oreosomes.	
	Oreosoma.

In the first column, reproduced from the Régne Animal (v. 2, pp. 158–171, and table méthodique), the intention was apparently to correlate the genera and subgenera with the genera established by Linnæus and to intercalate the subsequently discovered genera in place.

In the second column (in which, for present use, the Latin instead of the French terms are given) the sequence of the "Histoire Naturelle des Poissons" (v. 4, pp. 7, 8, *et seq.*) is shown.

The family thus defined was almost universally adopted from the time of its proposal until 1858, or at least, by the few who disintegrated it, the constituent families were kept closely approximated.

KAUP.

In 1858, Dr. J. J. Kaup, published observations on the mail-cheeked fishes,* for which he used the name "TRIGLIDÆ," introducing some

* Einiges über die *Acanthoptérygiens à joue cuirassée*, Cuv., Von Kaup." <Archiv für Naturgeschichte, 24. Jg. 1858, I, 329–343.

startling innovations. He proposed to remove from the family *Platycephalus*, *Bembras*, and *Hoplichthys*, and subdivided the family as follows:

II. Family TRIGLIDÆ.

1. Subfamily *Choridactylinæ*.

1. *Choridactylus*. 2. Polemius.* 3. Minous. 4. Apistus. 5. Cocotropus.†

2. Subfamily *Scorpæninæ*.

1. Pelor. 2. *Pterois*. 3. Oreosoma. 4. Scorpæna. 5. Synanceia.

3. Subfamily *Triglinæ*.

1. Cephalacanthus. 2. Dactylopterus. 3. *Peristethus*.‡ 4. Prionotus. 5. Trigla.

4. Subfamily *Cottinæ*.

1. Trichopleura.§ 2. Cottus. 3. Agonus. 4. *Hoplocottus*.‖ 5. Aploactis.

5. Subfamily *Agriopodinæ*.

1. Trichodon. 2. Blepsias. 3. Gasterosteus. 4. Tænianotus. 5. *Agriopus*.

Inasmuch as some of the names proposed in this and a subsequent article, in which the same fishes were considered from a similar point of view, are retained, it may be well to give Kaup's views and method of treatment. It will therefrom appear that there is nothing in common between his groups and those now adopted except the names and the typical constituents. The contributions of Dr. Kaup to ichthyology are indeed among the curiosities of scientific literature, and serious discussion of his views is unnecessary, if not impossible.

Before taking up this already numerous family, it is necessary to remove certain genera from it. Among these particularly is *Monocentris*, which represents the bony-fish among the *Scomberidæ*, as does *Peristethus* among the *Triglidæ*, or *Agonus* among the *Cottinæ*. *Hoplostethus* also does not belong here, but among the *Holocentrinæ*. This subfamily is thus arranged:

HOLOCENTRINÆ. 1. *Holocentrum*; 2. *Trachichthys*;¶ 3. *Rhynchichthys*; 4. *Beryx*; 5. *Myripristis*. *Holocentrum* is closely allied to *Rhynchichthys* and *Myripristis*, and *Trachichthys* with *Beryx*.

Monocentris differs principally by three soft ventral rays, which are reduced in number and length at the expense of the enormous ventral spine.

Cuvier and Valenciennes concede that *Hoplostethus* belongs to the Holocentrinæ, since they pronounce this genus as identical with *Trachichthys*.

Dr. Schlegel has from the examination of better preserved specimens rightly separated *Hoplichthys* and brought it into the subfamily *Callionyminæ*. Besides this, not only *Platycephalus*, but also *Bembras*, must be separated from this family, the first to be added to the *Acanth. abdominales* Cuv. and the last to the *Percoidei* Cuv.

However much we may coincide in the general praise of Cuvier and Valenciennes' excellent work, as to that which concerns the critical arrangement of materials at hand, clear definition of genera, and highly accurate descriptions, which we do with pleasure and sincerity, we do not equally admire the systematic classification. In this only a beginning is made, while the authors have been satisfied to place together in separate chapters the cognate forms. There are, therefore, in this work excellent materials towards a natural system, only they are put together without guiding principles, and thus the principal reproach against the work is that the authors have

---

* Pterichthys Sw., 2, 265. † Corythobatus Cant. ‡ Peristedion Lac.
§ Sthenopus R. ‖ Podabrus, Trachydermis, etc.

¶ That *Trachichthys* represents the *Earfish*; that is, in its subfamily, the bird-type, it is only necessary to read what Cuvier (p. 478) says of the ear of this genus. (Kaup.)

not sufficiently cleared themselves of the slough of earlier systematists, and have un luckily held them of too great account.

Of the idea that in all orders, families, etc., certain typical forms appear, there i in the whole work no trace, although there are genera enough which prove this ide most clearly.

We thus see in this family, which for brevity we will call *Triglidæ*, the greates possible development of the pectorals, with which some species raise themselves abov the water and move for a few moments in the air in order to escape the pursuit o their enemies.

In such elongated and winged forms as *Polemius* (*Apistus alatus*), *Pterois*, and *Dac tyloptera*, all the rays are single, and this characteristic is also found in *Blepsias* and *Cottus;* among the last there are species which have all the pectoral rays single, whil a few species only have isolated branched rays.

Among these generally long-winged forms the bird-type is foreshadowed, and I give them in their family, as in the class of birds, the second rank. The free finger-like, jointed rays, from 1 to 3 in number, and only serving for propulsion, which are seen in *Choridactylus*, *Polemius*, *Minous*, *Pelor*, *Peristethus*, *Prionotus*, and *Trigla*, placed in advance of the pectoral, appear to me to have some analogy with the 1 or 2 free fingers of the *Chiroptera*, which also serve as a means of propulsion on the earth. In one genus, too, *Gasterosteus*, which builds a nest, and where the male protects the eggs, I see a near analogy to the birds.

The teeth in no one genus are much developed, for they are mostly fine card-like ones in the jaws, and not often found in the vomerine or palatine bones, whence they are devourers generally of crustaceans, roe, or insects, and among them no (properly speaking) predaceous fish is found. All are true breast-finned fishes, and among a few only is the ventral somewhat behind the origin of the pectoral.

Although the ventral is always present, it is in most cases but little developed as compared with the pectoral. We find the same to be the case among the *Chiroptera*, the true Birds (*Fissirostres*), and the *Pterodactylidiæ* of the *Amphibians*, where the wings are likewise developed at the expense of the feet.

The bony fish constitutes another fundamental type, which is shown externally by its covering. As the bony system forms the third division among the anatomical systems and their representatives, the Amphibia take the same rank. I give to the genera *Oreosoma*, *Peristethus*, *Agonus*, and *Gasterosteus* in their subfamilies as the representatives of the *Osseous* fishes, the third position. The more predaceous forms, with maxillary teeth and medium-sized pectoral, I place as the fishes proper, in the fourth rank.

To the smallest forms, most often with large, abruptly falling head or large eyes, I give as the nervous type the first, and to the naked species, or such as are covered with numerous mucous pores (as in the last division of the genus Trigla), the last rank. It requires but little penetration to perceive that *Cocotropus* stands lower than *Choridactylus*, *Synanceia* lower than *Pelor*, *Trigla* (*lineata*, *cuculus*) lower than *Cephalacanthus*, and *Aploactus* lower than *Trichopleura*, so clear is it to the apprehension.

I have thus given to the *Triglidæ* the second rank in the second order of fishes, just as the swallows (*Fissirostres*) and the *Cheiroptera* hold the second rank in theirs, and to the separate subfamilies and genera their corresponding position. In this way only has the following table been formed. I will not venture to assert that it is perfectly faultless, but it will probably prove itself in the main correct.

After this summary, given in a translation of Dr. Kaup's own words, it is unnecessary to contravene his postulates and assumptions. They were subsequently dissipated by himself in an article* in which he

* Ueber die Familie Triglidæ nebst einigen Wertes über die Classification. Von J. J. Kaup, <Archiv f. Naturg., 1873, I, pp. 71–94.

roposed an entirely different classification of an artificial group which e called the suborder TRIGLOIDÆ, and from which he excluded many f the closest relations of the fishes combined under that name. His nodified views are expressed in the following scheme:*

II. Ordo STERNICHTHYES.

II. Subordo. TRIGLOIDAE. Acanthoptérygiens à joue cuirassée, Cuv. (part.)†

1. Hauptfamilie: Berycidæ.
. *Holocentrinæ*.(1
. Hoplostethinæ.(1
. Monocentrinæ.(1
. Polymixinæ.(2
. Berycinæ.(1

2. Hauptfamilie: Triglidæ [p. 84].
1. Cephalacanthinæ.
2. *Dactylopterinæ*.
3. Peristethinæ.
4. Prionotinæ.
5. Triglinæ.

3. Hauptfamilie: Platycephalidæ.
1.
2. Bembrasinæ.
3. *Hoplichthyinæ*.
4. Platycephalinæ.
5. Hemerocœtinæ.(3

4. Hauptfamilie: Scorpænidæ.
1. Sebastinæ.
2. Pteroinæ.
3. Oreosominæ [*sic!* 4].
4. *Scorpæninæ*.
5. Synanceinæ.

5. Hauptfamilie: Agriopodidæ.
1.
2. Apistinæ.
3. Oreosominæ [*sic!* 4].
4. Trichodontinæ.(5
5. Agriopodinæ.(6

The subfamilies indicated by the figure (1) have no relation to the mail-cheeked fishes, but belong to the superfamily *Berycoidea*; the *Polymixinæ* (2) are peculiar fishes representing a distinct family; the Hemerocœtinæ (3) belong to another alien, distinct family; the Oreosominæ (4) appear to be related to the Zenidæ; the *Trichodontinæ* (5) form the family *Trichodontidæ*, and the *Agriopodinæ* (6) the family *Congiopodidæ*, both remote from the mail-cheeked fishes. The treatment of the rest may be compared with that in the present article.

BLEEKER.

In 1859, Dr. Pieter von Bleeker published the outlines of a new classification of fishes,‡ in which he disintegrated and widely scattered the mail-cheeked fishes, as follows:

Caterva 1. Katapieseocephali.
Ordo 24. Percæ. (Subordo 4. Percichthyini. Sectio 1. Parastemiptori. Tribus 4. Trachycraniichthyini.)

---

* Kaup, o. c., p. 79.

† The Cottids and Agonids, as well as a number of other genera of typical mail-cheeked fishes, have been excluded from the "suborder" by Dr. Kaup. "Aus der Unterordnung Trigloidae habe ich die Heterolepidina als nicht hierher gehörig entfernt. Ebenso die Genera Enneopterygius Rüpp., Aploactis Schleg., Trichopleura Kp., Hemitripterus Cuv., Amphiprionichthys Blkr. und Micropus Gray (vielfach vergebener Name). Alle diese meist kleinen Genera gehören nicht zu den Trigloidae, sondern sind Theile der grossen Familie Cottoidae." *Kaup, o. c.*, p. 83.

‡ Enumeratio specierum Piscium hucusque in archipelago Indico observatorum, [etc.] auctore Petro equite a Bleeker, [etc.] Bataviæ, typis Langii & Soc. 1859.—The portion quoted is from the "Systematis Piscium naturalis tentamen" (pp. xi-xxxiii), especially pp. xxi, xxiv, xxv.

Familia 84. Scorpænoidei.*

Subfamilia 1. Scorpænæformes = Scorpænini Bp.

Gen. Pterois Cuv. (p. 42†), Pteroidichthys Blkr. (p. 42), Sebastes Cuv. (p. 4, Scorpæna L. (p. 41), Scorpænopsis Heck. (p. 41), Spinacanthus Ag. (fos, an huj. loc. ?).

Subfamilia 2. Apistiformes.

Gen. Pterichthys Swns. (p. 42), Apistus Cuv. (p. 43), Minous Cuv. (p. 4, Cocotropus Kp., Choridactylus Richds., Trichopleura Kp., Sthenop Richds., Aploactis T.Schl. (p. 44), Agriopus Cuv., Tænionotus Lac. (p. 4, Gnathanacanthus Blkr. (p. 246), Patæcus Richds., Amphiprionichth Blkr. (p. 44), Blepsias C. V., Peropus L. Benn.

Subfamilia 3. Synanceiæformes.

Gen. Pelor Cuv. (p. 45), Synanceia Bl. Schn. (p. 44), Synancideum J. Müll.

Caterva 2. Platycephalichthyes.

Ord. 32. Triglæ.

Familia 115. Trigloidei = Dactylei Dum.

Gen. Peristedion Lac. (p. 45), Dactylopterus Lac. (p. 45), Trigla L. (p. 4 Prionotus Lac. (p. 247), Cephalacanthus Lac., Petalopteryx Pict. (fo an huj. loc.?)

Familia 116. Aspidophoroidei = Agonidæ Swns.

Subfamilia 1. Aspidophoriformes.

Gen. Aspidophorus Lac., Hippocephalus Swns., Hippocephalichthys Blk, Agonus Bl.

Subfamilia 2. Canthirhynchiformes (Syngathoideis veris affines).

Gen. Aspidophoroides Lac. (Canthirhynchus Swns.).

Ordo 33. Platycephali.‡

Familia 117. Platycephaloidei = Platycephalinæ Swns.

Gen. Platycephalus Bl. Schn. (p. 108), Bembras Cuv. (p. 253), Hoplichth Cuv. (p. 250).

Caterva 3. Blennii.

Ordo 34. Cotti.§

Familia 120 Cottoidei = Cottini Bp. = Cottidæ Swns.

Gen. Bovichthys CV., Cottus L., Acanthocottus Gir., Aspidocottus Gir., Ar dius Gir., Leptocottus Gr. [Gir.], Calycilepidotus Ayr., Scorpænichth Gir., Clypeocottus Gir., Cottopsis Gir., Oligocottus Gir., Leiocottus Gi Centridermichthys Richds. (p. 218), Triglopsis Gir., Phobetor Kro Podabrus Richds. (Hoplocottus Kp.), Hemilepidotus Cuv., Hemitripter Cuv., Icelus Kroy. ?, Caracanthus Kroy. ?

Ordo 35. Blennii.

Familia 124. Chiroidei = Chiridæ Swns.

Gen. Chirus Stell. (p. 253), Oplopoma Gir., Ophiodon Gir.

Ordo 39. Cyclopteri Cuv. = Plekopteri Dum. = Cyclopteridæ Swns.

Familia 135. Cyclopteroidei.

Gen. Cyclopterus Art.

Familia 136. Gobiesocioidei.

Gen. Liparis Art., Gobiesox Lac., Lepadogaster Gouan, Sicyases M. Trosc Cotylis M. Trosch., Trachelochismus Bris., Sicyogaster Bris.

---

* The only family of the tribe.

† The numbers in brackets after the generic names refer to the pages of the follo ing "Enumeratio specierum Piscium hucusque in archipelago indico observatorun

‡ Familia 118. Callionymoidei = Callyonimini Bp. Gen. Callionymus L. (p. 10 Harpagifer Richds., Chænichthys Richds.

§ Familia 119. Batrachoidei = Batrachini Bp. Gen. Batrachus Klein (p. 123), A phichthys Swns., Porichthys Gir.

Some of the families, as thus constituted, have heterogenous elements, viz:

84. Scorpænoidei.

Agriopus is the representative of a peculiar family—perhaps related to the *Patæcidæ*.

Patæcus also represents a peculiar family, generally supposed to be related to the *Blenniidæ*.

Amphiprionichthys likewise represents a distinct family, the *Caracanthidæ*, as was later recognized by Bleeker.

Blepsias and *Peropus* (*Histiocottus* Gill)* belong to the family *Cottidæ*.

The subfamily *Synanceiæformes* was subsequently elevated to family rank by Bleeker himself.

117. Platycephaloidei.

Hoplichthys does not belong to the same family as *Platycephalus*, but represents a peculiar one.

120. Cottoidei.

Bovichthys is the type of a family related rather to the *Trachinoid* fishes.

Hemitripterus is isolated as a peculiar family type.

Caracanthus is generically identical with *Amphiprionichthys* which had been referred to the family *Scorpænoidei* by Bleeker on a previous page of the same work.

136. Gobiesocioidei.

The genus *Liparis*, referred to the family *Gobiesocioidei*, is not allied to that family, but is the type of a distinct family closely related to the *Cyclopteroidei*.

GÜNTHER.

In 1860, Dr. Albert Günther, in the second volume of the Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum, adopted the family of Cuvier, but with the name of "*Triglidæ*," and divided and subdivided it as follows, the families to which the several genera belong in the system now exhibited being indicated in the right-hand column:

Fam. 10. Triglidæ.

First group. HETEROLEPIDINA.

1. Chirus, *Steller*	Hexagrammidæ.
2. Ophiodon, *Girard*	
3. Agrammus, *Gthr*	
4. Zaniolepis, *Gir*	

* The name Peropus was pre-occupied in Herpetology.

Second group, SCORPÆNINA.

5. Sebastes, *C. et V.*	Scorpænidæ.
6. Scorpæna, *Artedi*	Scorpænidæ.
7. Glyptauchen, *Gthr*	Scorpænidæ.
8. Pterois, *Cuv*	Scorpænidæ.
9. Pteroidichthys, *Bleek*	Scorpænidæ.
10. Tænianotus, *Lacep*	Scorpænidæ.
11. Centropogon, *Gthr*	Scorpænidæ.
12. Apistus, *C. et V.*	Scorpænidæ.
13. Enneapterygius, *Rüpp*	Clinidæ.
14. Pentaroge, *Gthr.*	Scorpænidæ.
15. Tetraroge, *Gthr*	Scorpænidæ.
16. Agriopus, *C. et V.*	Congiopodidæ.
17. Posopodasys, *Cant*	Scorpænidæ.
18. Aploactis, *Schleg*	Scorpænidæ.
19. Trichopleura, *Kaup*	Scorpænidæ.
20. Hemitripterus, *C. et V.*	Hemitripteridæ.
21. Amphiprionichthys, *Bleek*	Caracanthidæ.
22. Synancidium, *Müll*	Synanceidæ.
23. Synanceia, *Schneid*	Synanceidæ.
24. Micropus, *Gray*	Caracanthidæ.
25. Minous, *C. et V.*	Scorpænidæ.
26. Pelor, *C. et V.*	Synanceidæ.
27. Chorismodactylus, *Rich*	Scorpænidæ.

Third group, COTTINA.

28. Podabrus, *Rich*	Cottidæ.
29. Blepsias, *C. et V.*	Cottidæ.
30. Nautichthys, *Gir*	Cottidæ.
31. Scorpænichthys, *Gir*	Cottidæ.
32. Cottus, *Artedi*	Cottidæ.
33. Centridermichthys, *Rich*	Cottidæ.
34. Icelus, *Kröyer*	Cottidæ.
35. Triglops, *Reinh*	Cottidæ.
36. Hemilepidotus, *C. et V.*	Cottidæ.
37. Artedius, *Gir*	Cottidæ.
38. Ptyonotus, *Gthr*	Cottidæ.
39. Polycaulus, *Gthr*	Synanceidæ.
40. Platycephalus, *Schneid*	Platycephalidæ.
41. Hoplichthys, *C. et V.*	Hoplichthyidæ.
42. Bembras, *C. et V.*	Platycephalidæ.
43. Prionotus, *Lacep*	Triglidæ.
44. Lepidotrigla, *Gthr*	Triglidæ.
45. Trigla, *Artedi*	Triglidæ.

Fourth group, CATAPHRACTI.

46. Agonus, *Bl*	Agonidæ.
47. Aspidophoroides, *Lacep*	Agonidæ.
48. Peristethus, *Lacep*	Peristediidæ.
49. Dactylopterus, *Lacep*	Dactylopteridæ.
50. Cephalacanthus, *Lacep*	Dactylopteridæ.
Xystophorus, *Rich*	Dactylopteridæ.

In 1861, Dr. Günther, in the third volume of his catalogue, proposed a new classification of the Acanthopterygian fishes,* which he distributed among nineteen groups, among which were (1) *Acanthopterygii perciformes*, (8) *Acanthopterygii cotto-scombriformes*, and (10) *Acanthopterygii blenniformes*. To each of those groups he referred certain of the mail-cheeked fishes, and elevated the four "groups" of the old family to family rank.

The ACANTHOPTERYGII PERCIFORMES were said† to have the "body more or less compressed, elevated or oblong, but not elongate; the vent is remote from the extremity of the tail, behind the ventral fins if they are present; no prominent anal papilla; no super-branchial organ; dorsal fin or fins occupying the greater portion of the back; spinous dorsal well developed, generally with stiff spines, of moderate extent, rather longer than or as long as the soft; the soft anal similar to the soft dorsal, of moderate extent or rather short; ventrals thoracic, with one spine and with four or five rays."

To this group the family of *Scorpænidæ* was referred.

The ACANTHOPTERYGII COTTO-SCOMBRIFORMES were said‡ to have "spines developed in one of the fins at least; dorsal fins either contiguous or close together; the spinous dorsal, if present, always short; sometimes modified into tentacles, or into a suctorial disk; soft dorsal always long, if the spinous is absent; anal similarly developed as the soft dorsal, and both generally much longer than the spinous, sometimes terminating in finlets; ventrals thoracic or jugular, if present, never modified into an adhesive apparatus; no prominent anal papilla."

In this group were placed the families *Cottidæ* and *Cataphracti*, as well as one subsequently added, called *Psychrolutidæ*.

The ACANTHOPTERYGII BLENNIIFORMES were defined§ as having the "body low, subcylindrical or compressed, elongate; dorsal fin very long; the spinous portion of the dorsal, if distinct, is very long, as well developed as the soft, or much more; sometimes the entire fin is composed of spines only; anal fin more or less long; caudal fin subtruncated, or rounded if present; ventral fins thoracic or jugular, if present."

In this group was included the family *Heterolepidotidæ*.

When the definitions of the several groups thus reproduced are analyzed, and especially when their constituents are taken into consideration, it becomes evident that the essential characteristics of the three groups are to be found in the comparative length of the spinous and soft portions of the dorsal and the length of the anal, while all the

* Systematic synopsis of the families of the Acanthopterygian fishes. Appendix to v. 3 (10 pp.). The diagnoses of these groups are quoted from a later work of the same author, "An Introduction to the Study of Fishes," 1880. They are essentially the same as in the "Systematic Synopsis."

† Op. cit., p. 374.

‡ Op. cit., p. 438.

§ Op. cit., p. 490.

other characters are interchangeable or alternative, and not necessa rily co-ordinated with the essential characters in question.

The manner and extent to which the groups and families recognizec by Dr. Günther traverse the superfamilies and families adopted in the present article will appear from the following exhibit, in which the firs column gives the groups of Günther, the second the families herein adopted, and the third the superfamilies which embrace them.

Groups and families of Günther.*	Families of Gill.	Superfamilies of Gill.
1. A. perciformes:		
Scorpænidæ	Scorpænidæ	Scorpænoidea.
	Congiopodidæ†	
	Hemitripteridæ	Cottoidea.
	Caracanthidæ	Scorpænoidea.
	Synanceidæ	
8. A. cotto-scombriformes:		
Cottidæ	Cottidæ	Cottoidea.
	Synanceidæ	Scorpænoidea.
	Platycephalidæ	Platycephaloidea.
	Hoplichthyidæ	
	Triglidæ	Trigloidea.
	Rhamphocottidæ	Rhamphocottoidea.
Cataphracti	Agonidæ	Agonoidea.
	Peristediidæ	Trigloidea.
	Dactylopteridæ	Dactylopteroidea.
10. A. blenniformes: Heterolepidotidæ	Hexagrammidæ	Scorpænoidea.

COPE.

In 1871, Professor Cope presented to the American Association fo the Advancement of Science an elaborate communication on the sys tematic relations of the true fishes. It is especially noteworthy for th attention which was paid to modifications of the skeleton, and abov all of the pharyngo-branchial apparatus. His order of *Percomorph* which embraced most of the Acanthopterygians of Cuvier, was divide into seven groups, of which the third was named *Scyphobranchii* an the fifth *Distegi*.

The group SCYPHOBRANCHII was named for those Percomorphs whic have the "basis cranii simple, no tube, post-temporal furcate; superic pharyngeals shortened; fourth and first generally wanting; third large basin-shaped; second generally scale-like or co-ossified with third scapula with median foramen; dorsal radii usually soft."

To this group, among others, were referred the family *Cottidæ* (wit the genera *Uranidea*, *Cottus*, *Leptocottus*, *Hemitripterus*, and *Scorpæ nichthys*) and the group *Aspidophoridæ*.

The DISTEGI are those Percomorphs having the "basis cranii doubl with muscular tube, post-temporal bifurcate; scapula with median for men; basal pectorals three or four, short, quadrate; superior phary geal bones four; third always the largest, longitudinal, more or le

* The *Psychrolutidæ* and *Cyclopteridæ* of Dr. Günther are also true mail-cheeked fishes, althou not so regarded by that gentleman. The *Psychrolutidæ*, indeed, so far as yet known, are not dist guishable from the *Cottidæ*. (See Proc. U. S. Nat. Mus., 1888, pp. 321-327.)

† The *Congiopodidæ* (or *Agriopodidæ*) are not true mail-cheeked fishes, but rather related to t *Patæcidæ*, which have been associated by Dr. Günther with the *Blenniidæ*.

elongate, not articulated to the cranium; inferior pharyngeals separated; dorsal fin with strong spines."

To this group was referred a section (with the genera *Pterois*, *Synanceia*, *Scorpæna*, *Pelor* (tube rudimental), *Peristedion*).

DARESTE.

In 1872, Mr. Camille Dareste published the result of osteological studies on the bony fishes.* In regard to the fishes with mailed cheeks, he recognized that there was much diversity among the constituents of the Cuvierian family, and concluded to defer the expression of an opinion on the several types until he could make further studies. He considered that the extension of the suborbitals over the cheeks was an entirely artificial character and unconnected with the variations in the relations of the cranial bones, and that the osteology is much more diversified in the fishes associated under that family than in other groups; he especially instanced the Triglids and Dactylopterids as two groups which exhibit great diversities, although he considered them to be closely related.

It is quite true that the mere extension of the suborbital bones over the cheeks would be of comparatively slight value, and a combination of fishes on that ground alone would be purely artificial; but it is an instance rather of the genius of Cuvier that he wisely limited and checked his conclusions. It is not merely the expansion of the suborbitals, but the development of a specific suborbital in a special way that distinguishes the true mail-cheeked fishes of the normal types, such as the *Scorpænidæ* and *Cottidæ*. The other groups that have been associated with them, differing in the extent of the suborbital bones, are associated because they possess other characters in common with the least abnormal mail-cheeked fishes. As to the Triglids and Dactylopterids, it is now certain that they are not as closely related as has been supposed, but that the structural characters distinguishing them are of great importance and necessitate their wide separation. But at the same time it must be admitted that they should be approximated, although simply because there is no closer relation to any other form than the *Triglidæ* on the part of the *Dactylopteridæ*.

Mr. Dareste's words are as follows:

La famille des *Poissons à joues cuirassées* présente une telle varieté de formes crâniennes, même dans les genres les plus voisins, qu'il m'a été impossible jusqu'à présent de savoir s'ils appartiennent à un même type, ou s'ils se rattachent à plusieurs types différents. Je dois donc réserver complétement pour un autre travail le groupe tient de ces animaux; Je me contenterai de faire remarquer d'abord que le caractère des joues cuirassées, c'est-à-dire de l'extension des sous-orbitaires sur les ailes palatine et temporale, est un caractère purement artificiel, puisqu'il se rencontre dans des genres

* Dareste (C.). Études sur les ostéologiques des poissons osseux. <Comptes rendus Acad. Sc. (Paris), t. 75, pp. 942–946, 1018–1021, 1086–1089, 1172–1175, 1253–1256, 1872.

Sept. 25, 1889.

bien différents, comme l' *Anabas*, le *Myletes* et le *Sudis;* ensuite, que les variations dans les connexions des os crâniens sont bien plus nombreuses que dans d'autres groupes. C'est ce que l'on voit, par exemple, en comparant les *Trigles* et les *Dactyloptères*, bien que ces deux genres soient fort voisins.

SEGOND.

In 1873, Dr. D. Segond also published a memoir on the skeletal affinities of fishes,* in which he especially opposed the views of Dareste. Without going into the merits of the controversy, which appear, however, to be rather or mainly with Dareste, it is only necessary in this place to advert to the fact that Dr. Segond recognized four principal types among fishes, of which the Perch (*Perca*), Mullet (*Mugil*), Carp (*Cyprinus*), and Shark (*Squalus*) are the representative examples. To the Perch type he referred the families *Scorpænidæ* and *Cottidæ*, and to the type of *Mugil* the family of *Chiridæ*. It is certain that in this respect, at least, the classification is entirely negatived by the skeleton, as well as by other characters. His views may be best left to himself for explanation.

La situation donnée aux Trigles dans la dernière édition du Régne animal est des plus caractéristiques; en effet, malgré la spécialité morphologique de la tête, les Trigles ont les plus grandes affinités avec les Perches si l'on considère les parties fondamentales du squelette. Cette affinité se lit facilement chez les Trigles proprement dits, les Scorpènes, les Pterois, les Agriopes, les Synancées; mais si l'on regarde l'ensemble de la région abdominale des Prionotes, Malarmats, Dactyloptères, Cottes, on sent la nécessité d'établir entre les Trigles une subdivision essentielle, sans rompre cependant les liens généraux si intimes de ce groupe. Si nous confrontons un Scorpène avec les Percoïdes les mieux caractérisés, nous reconnaissons d'abord la légitimité de la situation de cette famille dans l'arrangement de Cuvier, puis, si nous opposons ce Scorpène à un Cotte, nous sommes frappés par une différence spéciale dans la forme générale des côtes et aussi par leur disposition et leur connexion avec le corps des vertèbres.

Pour la disposition générale, il faut d'abord confronter un Cotte avec un Trigle, le Chabot par exemple avec le Rouget; on reconnait alors que, sauf la proportion de l'élément transverse, il y a entre ces deux squelettes de profondes analogies. Mais si l'on veut remarquer ensuite dans l'ensemble des Trigles le mode de connexion de la côte avec le corps de la vertèbres dans les premiers segments abdominaux, on reconnait alors que la conformation du Chabot n'est que l'extension, à une grande partie de la colonne abdominale, de la disposition qu'on remarque seulement en avant dans l'ensemble des Trigles. D'après ces observations morphologiques, je pense qu'il faut restaurer l'ancienne distinction de Linné entre les Trigles, les Cottes et les Scorpènes. En plaçant les Scorpènes en tête des Trigles comme se rattachant plus directement aux Percoïdes, on les fait suivre des Pterois, Blepsias, Apistes, Agriopes, Pelors, Synancées et Lepisacanthes; viennent ensuite les vrais Trigles, avec les Dactyloptères, Céphalacanthes, Malarmats et Prionotes; enfin les Cottes avec les Platycephales (*Cottus insidiator*), les Hémitriptères et les Hémilepidotes. Quant aux Epinoches, on peut en dehors de leurs caractères génériques, les ranger après les Cottes, tout en leur

* Segond (D.) Des affinités squelettiques des poissons. <Journ. de l'Anat. et la Phys., 9e année, pp. 511-534, 607-627, 1873.

Four principal types are recognized as exemplified in *Perca, Mugil, Cyprinus*, and *Squalus*.

reconnaissant des relations fondamentales avec les Trigles. Cette dernière situation acceptée par Cuvier est une des preuves les plus intéressantes de l'importance qu'il a dû attacher aux parties fondamentales du squelette. N'ayant pas eu à ma disposition des squelettes d'Oreosome, je les conserverai ici après les Epinoches, sur le dire de Cuvier. (Pp. 532, 533.)

SAUVAGE.

In 1873, Dr. Sauvage published a special memoir upon the mail-cheeked fishes* and distributed them among three families—the *Scorpænidæ*, *Platycephalidæ*, and *Triglidæ*. He availed himself of some anatomical characters, but not in all cases happily. The family of *Triglidæ*, for example, was characterized by suborbitals covering the whole cheek, but, as Cuvier long ago showed, the suborbitals do not cover the hinder portions of the cheeks in the Dactylopterids. The nasals were said to be soldered in a large plate covering the greater part of the muzzle, but this statement does not appear to be strictly applicable to any of the several types which are combined under the family called by Sauvage *Triglidæ*. Another of the characters given to Sauvage's family, the development of four to six ganglionic tubercles at the origin of the spinal marrow, is applicable to the typical Triglids and probably to the Peristediids, but not to the Dactylopterids, and there is no reason to suppose that it belongs to the Agonids. Further, a subdivision of the cataphract Triglids is made into two groups, distinguished by the development of an interparietal bone (as in the Dactylopterids) or the destitution of it (as in the Agonids and Peristediids). In fact, there is no such difference, and the antithesis is probably due to the malidentification of the bones in the Dactylopterids, where a superficial dermal bone was considered interparietal. The true interparietal, or supra-occipitine, is entirely concealed from the roof of the cranium in the Dactylopterids by a special system of dermal bones, while on the other hand, in the Agonids, it is more than usually well developed (for the mail-cheeked fishes), and extends forwards between the parietals, in part uncovered, and meets the frontals. In the Triglids and the Peristediids it is well developed, but visible only from behind, its anterior or horizontal portion being covered by the overlapping parietals.

Credit is to be given to Dr. Sauvage for the characters derived from the development of the pelvic bones, for using the number of branchiæ, and for utilizing the presence or absence of pseudo-branchiæ as family characters. He has neglected, by name at least, the *Hexagrammidæ*, and the genus *Agriopus* has been presented in the *Scorpænidæ* as

---

*Sauvage (H. Émile). De la classification des poissons qui composent la famille des Triglides (Joues-cuirassées de Cuvier et Valenciennes). <Comptes Rendus Acad. Sc. (Paris), t. 77, pp. 723-726, 1873; *also*, Description de poissons nouveaux ou imparfaitement connus de la collection du muséum d'histoire naturelle. Famille des Scorpénidées, des Platycephalidées et des Triglidées. <Nouv. Archives Mus. Hist. Nat., Paris (2), t. 1, pp. 109-158, pl. 1, 2, 1878.

by all his predecessors. His diagnoses of the several families are as follows:

I. SCORPÆNIDÆ: Dentition faible, dents en velours, pas de canines. Sous-orbitaires s'articulant d'une manière mobile avec le préopercule, ne couvrant jamais toute la joue; os nasaux libres et petits. Peau, ou nue ou revêtue d'écailles, parfois épineuse, jamais cuirassée; ventrales thoraciques supportées par un os du bassin long, les deux os étant en contact et soudés. Des pseudobranchies: trois branchies entières et une demi-branchie; quatre fentes branchiostéges [branchiaux]. Pas de tubercules sur la moelle, en arrière du *calamus scriptorius.*

A. SCORPÆNI: Corps revêtu d'écailles ordinaires (*Sebastes, Scorpæna, Pterois, Tænionotus*, groupe des *Apistes*).

B. COTTINI: Corps ou nu ou portant des écailles épineuses (*Hemitripterus, Synancidium, Synanceia, Minous, Pelor*, groupe des *Cottes, Icelus, Triglops, Polycaulus, Hemilepidotus.*

II. PLATYCEPHALIDÆ: Tête aplatie et comme écrasée. Corps aplati antérieurement. Dentition faible, pas de canines. Deux dorsales: la première épine séparée des autres. Ventrales thoraciques, largement séparées; os du bassin jamais réunis ni soudés, laissant entre eux un très grand intervalle (*Platycephalus*).

III. TRIGLIDÆ: Sous-orbitaire, s'articulant d'une manière presque fixe, ou du moins à peine mobile avec le préopercule, et couvrant toute la joue. Nasaux soudés en grande plaque, couvrant la plus grande partie du museau. Ventrales thoraciques et réunies. Pseudobranchies; arcs branchiaux complets; cinq fentes branchiostèges [branchiaux]. De quatre à six tubercules ganglionnaires à l'origine de la moelle.

A TRIGLINI. 1er groupe, *Trigli:* corps revêtu d'écailles ordinaires (*Trigla, Lepidotrigla, Prionotus, Bembras*); 2e groupe: corps ayant des écailles et des plaques: *Hoplichthyi* (*Hoplichthys*).

B. CATAPHRACTI. 1er groupe: un interpariétal: *Dactylopteri* (*Dactylopterus, Cephalacanthus*); 2e groupe: pas d'interpariétal: *Peristethi* (*Agonus, Agonomalus, Peristhedion*).

JORDAN AND GILBERT.

Among the most recent investigators of the mail cheeked fishes have been Professors Jordan and Gilbert. They have added greatly to our knowledge of the American species and have unveiled the richness of the group represented in the North Pacific. In their "Synopsis of the Fishes of North America" (p. 640), they have advocated the naturalness of the group. They maintained that "the *Chiridæ, Scorpænidæ, Cottidæ, Agonidæ, Triglidæ, Liparididæ*, and *Cyclopteridæ* form a closely-related series (*Cataphracti*), and are distinguished from all the other *Acanthopteri* by the presence of the suborbital stay. Different writers have widely separated some of the members of the group from the others, but the relations of each, especially of the *Scorpænidæ, Agonidæ*, and *Liparididæ* with the *Cottidæ* are so close that it is difficult to draw satisfactory boundary lines." Detailed descriptions are given of each of the families thus enumerated; but, inasmuch as their work is confined to the North American fishes, they did not take cognizance of the types which form the families *Caracanthidæ, Platycephalidæ*, and *Hoplichthyidæ*, and, from their descriptions, it is not certain what would be done by them with the representatives of those families. The cardinal characters given to the families recognized by them are the comparative armature of the head, the development or want of slit behind the fourth

branchial arch, and the relations of the gill-membrane of the respective sides. In their analysis (p. 401) they have represented the relationships and characteristics of the several families in the following manner:

DD. Suborbital with bony stay. (Cottiform fishes.)
  v. Head not mailed.
    x. Slit behind fourth gill large; body evenly scaled .... *Chiridæ*
    xx. Slit behind fourth gill small or wanting.
      y. Gill-membranes separate, free from isthmus; ventral fins normally formed, mostly I, 5 .... *Scorpænidæ*.
      yy. Gill-membranes broadly joined, attached to the isthmus or not; ventral fins variously imperfect .... *Cottidæ*.
  vv. Head mailed, externally bony.
    z. Ventrals few-rayed, close together; last gill-slit obsolete. *Agonidæ*.
    zz. Ventrals I, 4, or I, 5, usually wide apart; last gill-slit large. *Triglidæ*.

Those having a suborbital stay but having the "breast with a sucking-disk" are divided into two families:

b. Skin smooth; vertebræ very numerous .... *Liparididæ*.
bb. Skin tubercular; vertebræ rather few .... *Cyclopteridæ*.

It will thus be seen that the characteristics of the families given by Professors Jordan and Gilbert are not of great importance, and we need not be surprised, therefore, that they considered that "the relations of each, especially of the *Scorpænidæ*, *Agonidæ*, and *Liparididæ* with the *Cottidæ* are so close that it is difficult to draw satisfactory boundary lines." The characteristics assigned by them to the families are, however, co-ordinate with osteological characters of far greater importance which confirm their families so far as they go, but it will become evident hereafter they have not gone far enough, and the families require to be multiplied. The characters of the additional families to be admitted are of fundamental importance and greater than those assigned by the authors to the families admitted by them.

OWEN.

Among the statements relating to the skeleton, one occurs which should not be passed over in silence, and which may be aptly noticed in this place. According to Professor Owen (Anatomy of Vertebrates, v. I, p. 111), the subtectals or "*orbitosphenoids*" are "sometimes represented by a descending plate of the frontal, as in the Garpike, or *by unossified cartilage, as in mail cheeked fishes*."

This statement must surely be the result of some confusion of notes or misapplication of the name "mail-cheeked fishes." In all the species of that series which I have examined (and which must have been many more than observed by Professor Owen), the so-called orbitosphenoids or subtectals are very distinctly developed, and the modifications of those bones have been found to be very useful in the determination of the relationships of the species, as well as for diagnostic purposes. Whatever may have been the basis of observations, the statement at any rate is altogether too sweeping and vague.

PRINCIPLES OF CLASSIFICATION.

The question now comes up, which of the views entertained respecting the classification of the mail-cheeked fishes and promulgated are the more correct? Three of the systems adverted to may be specially considered: (1) the Cuvierian, in which all the mail-cheeked fishes were associated closely together; (2) the Güntherian, wherein those fishes are segregated according to the relative proportions of the spinous and soft parts of the dorsal fin; or (3) the Copean, in which the primary distinction is based upon the development or non-development of the so-called muscular tube, or, in other words, whether there is a double or single "basis cranii," and whether there are two or four epipharyngeal bones on each side.

Considering the various forms with reference to the development of the dorsal fin, we find that at least some forms (*Caracanthi*) that have been referred to the family *Scorpænidæ* by Günther actually have the soft portion of the dorsal longer than the spinous portion, and not, as the definition requires, the proportions reversed. We also find that it is difficult in practice to fit the definitions to certain fishes, for there is really a gradation, if we take into account all those which have been thus distributed into the four Güntherian families, between those forms with an elongated spinous portion and those with an abbreviated spinous portion of the dorsal fin, as well as those having a short or long anal fin. It is found also that the groups of Günther traverse those proposed by Cope, and that the characters derived from the structure of the dorsal fin are not co-ordinated with those of the skeleton as signalized by Cope or by nature. Thus it appears that the *Triglidæ*, which, by Günther, are associated with *Cottidæ*, are by Cope separated from the latter and approximated next to the *Scorpænidæ*, while, on the other hand, the genus *Hemitripterus*, which, by Günther, is referred to the family *Scorpænidæ*, is by Cope considered to be one of the constituents of the family *Cottidæ*.

Long ago the present author had considered the questions thus involved and had been led to the conclusion that the various mail-cheeked fishes had been, on the whole, naturally associated by Cuvier, although of course, in accordance with modern views, the species constituting the family of Cuvier required to be segregated into at least a number of families. He had found that the development of the dorsal fin was of much less value than had been claimed for it by Günther, and that the definitions of Cope referring to the double or single basis cranii were inapplicable in the classification of these fishes.

All of the *Cottidæ* naturally have a double "basis cranii" although less developed than in the *Scorpænidæ*, nor would the term "rudimentary," even, be applicable to the condition exemplified in the *Cottidæ* whatever may be the sense in which that word has been used by Professor Cope with reference to the genus *Pelor*, which is said to have the

"tube rudimentary." This so-called "tube," be it remarked, is a chamber for the insertion of the *rectus* muscles of the eye; this is isolated from the brain cavity by the development of a platform from the basioccipitine continuous with horizontal ridges or shelves diverging from the inner walls of the prootic bones and meeting along the middle, thus constituting a roof for the muscular chamber and a floor for the cranial cavity. This special chamber may be called the MYODOME.* The chamber, as can be readily seen by bisection of the skull of any Cottid, is too well developed to be called "rudimentary," and in *Scorpænichthys*, also referred to by Professor Cope, it is actually little less if not indeed quite as well developed as in the *Scorpænidæ*, and does not differ from that of the *Trigloidea*, and only differs from that of the *Scorpænidæ* by the transverse anterior margin of the shelf and the absence of the dichost or so-called basi-sphenoid bone. We have, in fact, among the mail-cheeked fishes almost all transitions. In the *Hexagrammidæ* or *Chiridæ* the basisphenoid bone is almost if not quite as well developed as in the majority of acanthopterygian fishes, and sends down processes to the parasphenoid. In the *Scorpænidæ* it is developed mostly as a triangular element in front, and has no descending process, while in the *Cottidæ* it appears to be entirely absent. In all of these fishes, however, the muscular cavity is differentiated, and the only difference, exclusive of the presence or absence of the dichost or basi-sphenoid, is the relative extension forwards or projection of the roof of the muscular cavity. The principal deviations from the standard occur in the Hemitripterids, the Cyclopterids, and the Dactylopterids.

So great is the variation in this group, and so widely do some types deviate from the pattern exhibited by the typical acanthopterygian fishes, that a number of exceptions are manifested by various forms to the characters by which Professor Cope has restricted the major groups including them. This proposition holds true not only as to the subordinal or equivalent groups, but as to the orders and even the tribes.

The tribe of Physoclysti (Physoclisti) is defined as having, among other characters, "the parietals entirely separated by the supra-occipital." This character, however, is not exemplified by the Hemitripterids, Cottids, Triglids, and Peristediids, for in all those families the parietal bones approach and join each other by suture overlapping the supra-occipital.

The order of Percomorphi is defined as having, among other characteristics, the "epiotics normal; no interclavicles; post-temporal not co-ossified with the cranium; basal pectoral radii not enlarged," and "the sub- and inter-operculum present, plate-like." Exceptions occur among the mail-cheeked fishes to each of these generalizations.

The epiotics can not be said to be normal in such forms as the *Agonidæ*, *Triglidæ*, *Peristediidæ*, and *Dactylopteridæ*, in which they are specially modified for union with the supra temporals and otherwise.

---

* Myodome: Gr. *μυα* (*μυος*), muscle; *δομος*, chamber.

Interclavicles have been attributed to the *Cottidæ*, by Professor Parker.

The post-temporals are firmly co-ossified with the cranium in at least the *Triglidæ*, *Peristediidæ*, and *Dactylopteridæ*, and to such an extent that it is very difficult to trace the line of union between them, the sutures being less distinct than those between others of the normal bones of the cranium.

The "basal pectoral radii" or actinosts are much enlarged in the *Hemitripteridæ* and *Cottidæ*, whereof a portion are joined directly to the proscapula and widely separate the hypercoracoid and hypocoracoid.

The inter operculum is entirely separate from the other opercular bones in the Peristediids and Dactylopterids. In the Peristediids they are elongated and blade-like laminar bones, but in the Dactylopterids they are atrophied and reduced to osselets under the extended anterior portion of the preoperculum just behind the lower jaw.

The muscular tube whose presence or absence determines the position in Professor Cope's system of various forms is present in all of the typical mail cheeked fishes except the *Hemitripteridæ* and *Dactylopteridæ*, but in the former it is replaced by a modified device, while in the latter it is wholly wanting; it is as well developed in the Cottids, referred by Cope to the *Scyphobranchii* as in the Triglids and Peristediids placed by him among the *Distegi*.

It is indeed more than probable that the real reason which influenced Professor Cope to segregate the mail-cheeked fishes as he did was not the presence or absence of the myodome, but the development of two or four epipharyngeals.

The number of epipharyngeals, however, is not co-ordinate with the development or atrophy of the myodome, as may perhaps have been assumed. In this connection, too, it may be explained that the rudimentary and edentulous epipharyngeals have been counted by Professor Cope as well as the dentigerous ones. There is only one pair of dentigerous epipharyngeals in the Cottids and Hemitripterids, and there are three in the typical Scorpænids, Triglids, and related forms. But in forms otherwise closely agreeing with the typical *Scorpænidæ* in osteological characters—the *Apistinæ*—there are only single epipharyngeals, as in the Cottids. We are consequently led to the conclusion that the development or non-development of a myodome and the number of epipharyngeals are of less systematic importance than Professor Cope (quite naturally) inferred.

If the deviations from the diagnoses of Professor Cope have been thus detailed, it is not in the line of criticism, but because that accomplished zoologist has so well studied the osteological characteristics of the fishes. The uniformity in respect to the parts commented upon is so great in most of the forms belonging to the groups diagnosed that it has impressed him, perhaps unduly, and, by the contrast, the wide and

exceptional range of variation among the mail-cheeked fishes can be effectively presented to the general student of ichthyology.

It may be asked, what is the reason for the great difference between the system herein proposed for the mail-cheeked fishes and those followed by previous writers? It is sufficient to reply that we have been guided by a consideration of the entire structure and by the assumption that the whole is greater than any of its parts. In some, at least, of the previous essays at subdivision and segregation of the group, the principle that a part is greater than its whole, although of course not avowed, has been practically carried out. In this connection we may recall the principles of the father of natural history, which have too often been disobeyed, and which deserve re-enforcement, even though their formulator himself often sinned against them:

Quæ in uno genere ad genus stabiliendum valent, minime idem in altero necessario præstant.

Scias characterem non constituere genus sed genus characterem; characterem fluere e genere, non genus e charactere; charactererem non esse, ut genus fiat, sed ut genus noscatur. (Linn., Phil. Bot., § 169.)

COMPARISON.

It is interesting and instructive to note the different manner in which the group of mail-cheeked fishes has been treated by three prominent investigators.

Cuvier, the man of great genius and talents, amongst the scattered masses of fishes which he was called upon to consider, noticed the superficial resemblance between the various mail-cheeked fishes, and his search for a common character was rewarded by the discovery of the development of the enlarged elements of the suborbital chain, on account of which he named the group designated by him as the family of "mail-cheeked" fishes (*Joues-cuirassées.*)

Günther, a man meritorious for industry, but deficient in genius and scientific tact, failed to appreciate a generalization already duly formulated. Impressed by the most superficial characters, he ignored the generalization of Cuvier, widely separated the constituents of the group recognized by the great naturalist, and associated the scattered members with forms with which they have little or no relationship. This divorce has been dissented from or protested against as unnatural by almost all the French and Scandinavian as well as American ichthyologists. So potent, however, has been the influence of a great work—great in the sense of voluminous and as the outcome of laborious industry—that the most unnatural classification proposed by the anglicized ichthyologist has been followed by almost all the English and German naturalists.

Kaup, the "nature-philosopher," applied fancy to his consideration of the group, and its results have already been exhibited.

GENETIC RELATIONSHIPS.

In view of the wide range of variation that has been shown to be manifested by the various members of the great group of mail-cheeked fishes, it may be considered that it is not a natural group. In one sense it is not. The differences are certainly sufficient to justify the segregation of its elements not only into a number of families, but into seven superfamilies. Nevertheless the relations between the various members are such as to indicate that they form a natural although much interrupted series, and the genius of Cuvier is apparently justified by a detailed examination of the anatomy.

The most generalized of the mail-cheeked fishes appear to be the Scorpænoidea; these have the general form of ordinary fishes, like the Serranids, Sparids, and numerous others. Osteology also corroborates the nearer relationship of those forms to the normal acanthopterygian fishes. If we look around among those normal forms for the nearest relatives of the mail-cheeked fishes, in the present state of our knowledge, we appear to at least approximate the truth in claiming for them a nearer relationship with the Cirritids than any others. This view, however, is simply hypothetical and can not be considered to be established until we become better acquainted with the anatomy of the various members of the suborder Acanthopterygii. Which of the Scorpænoidea are the most generalized is a more difficult question to answer.

In some respects the Chirids, or Hexagrammids, appear to be more generalized than the Scorpænids. They are less armed with spines than the other representatives of the great group of mail-cheeked fishes, and, what is still more significant, the dichost or basi-sphenoid is more developed and approaches in form that exemplified in the normal Acanthopterygians; nevertheless, the parietal bones converge towards the front so as to almost, if not quite, touch over the front of the supraoccipitine. The parasphenoid sends elongated processes upwards to meet corresponding processes of the subtectals or orbito-sphenoids. In both of these characters they deviate from the Scorpænids and approach the Cottids. For this reason, therefore, they are placed after the Scorpænids and before the Cottids. The comparatively slight value of the approximation or separation of the parietals thus appears and demonstrates that it is inadvisable to separate widely groups resembling each other in so many characters because of such differences.

An elongate spinous portion of the dorsal fin and an inversely short rayed portion are developed in the Hemitripterids; nevertheless, those fishes agree in most osteological as well as most external characters with the Cottids; consequently the unnaturalness of removing them afar from the Cottids and associating them with the Scorpænids, as well as the slight value of the relative proportions of the spinous and rayed portions of the dorsal fin, becomes evident.

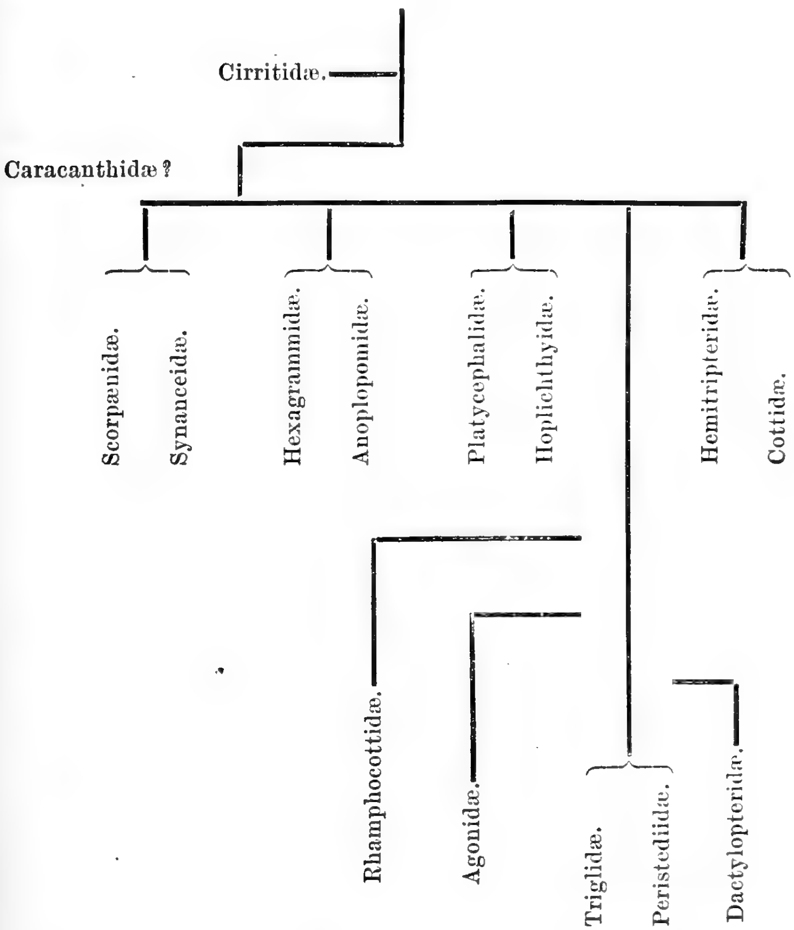
The osteological characters of the Platycephalids and Hoplichthyids

are imperfectly known, and it remains for future investigation to determine what are their exact relationships and characteristics.

The Triglids and Peristediids depart very widely from the other groups, as will become hereafter manifest, but, notwithstanding, their relationships appear to be more intimate with the generalized mail-cheeked fishes than with any other group.

The Dactylopterids depart still more from all other fishes than do the Trigloidea. We look in vain, however, for any nearer relation of those fishes than the Trigloidea, and consequently it may be assumed that they are the derivatives from a type from which the Triglids have least diverged.

In fine, the relationships of the various families of mail-cheeked fishes, in the present state of our knowledge, may be expressed in the following genealogical tree in which the left-hand branch in each case represents the more generalized type of each pair:



In this connection it seems advisable to refer to views enunciated by Prof. W. Kitchen Parker. That eminent anatomist has proposed to

divide the "'Pisces Acanthopteri' of Müller" into "an atypical and a typical assemblage. The former should take in the Trigloid, Cottoid, Gobioid, and Lophioid families; all these are more or less aberrant and come into proximity to the *sub-ganoid* types, and even to the true Ganoidei."*

If the contention of the present author is correct, the views of Professor Parker are wholly inadmissible. Far from approximating the Ganoids, the mail-cheeked fishes are among the most remote from them, and any characters in which they may be supposed to resemble them, such as the enlargement and development of scales into plates, are secondary and not primitive features. Still more specialized and remote from the Ganoids are the "Gobioid and Lophioid families." The evidence in favor of this contention appears to be overwhelming. Professor Parker considers that the "*Cottus bubalis*," his "first instance, is the best connecting link between the Ganoid and sub-ganoid types already described and the true typical Teleostei, the Percoids and their allies; moreover, another Cottoid—the Pogge (*Agonus cataphractus*)—re-assumes the ganoid covering."† It appears to me conclusive that the Scorpænoids are the most generalized and least divergent of the series and derived from (and not ancestral or subancestral to) the perciform fishes, while it is equally indisputable that the Cottoids are divergent in a still greater degree in the road of specialization foreshadowed in the Scorpænoids; and to even still greater a degree are the Agonoids, the Trigloids, and the Dactylopteroids divergent.

SYSTEMATIC SUMMARY.

As it has been shown in the preceding pages that the characters made use of by previous ichthyologists, based as well on external features as on anatomical peculiarities, are not co-ordinated in the manner claimed, it became necessary to examine in detail the various types that have been referred to the mail-cheeked fishes. This has been done by means of the skeletons and alcoholic collections in the National Museum. I have thus been enabled to study the skeletons of representatives of all the families that have been admitted except two, the *Caracanthidæ* and the *Rhamphocottidæ*. The former family is not represented in the National Museum even by an alcoholic specimen, but of the latter there is a moderately well preserved example which permits an interpretation, at least, of skeletal characters. It is quite probable that the *Caracanthidæ* represent a peculiar superfamily, while the *Rhamphocottidæ*, if I interpret correctly their characters, also represent a superfamily. The following synopsis exhibits the chief, or at least the most obvious, characteristics of the several superfamilies. It will be

* Parker (W. K.). A Monograph on the Structure and Development of the Shoulder-girdle and Sternum in the Vertebrata. London, 1868. (p. 42.)

† Parker, *op. cit.*, p. 43.

seen that most of the characters used have not before been employed in the taxonomy of the group, and that some are specially noteworthy, inasmuch as they militate against the conceptions of uniformity within the order even to which the group belongs.

I. Acanthopterygii buccis loricatis.

Acanthopterygians with the scapular arch normal, the post-temporal[1] and postero-temporal[2] forming part, and the latter intervening between the post-temporal and the proscapula.[3] Infraorbital chain with all bones entering into the orbital margin and functional, only partially extended over the cheek; with the third bone hypertrophied and developed as a stay impinging on the anterior wall of the preoperculum; post-temporal variously connected with the epiotic and pterotic; intermaxillines[4] with well-developed ascending pedicles gliding over the front of the prosethmoid.[5]

SYNOPSIS.

A. Myodome[6] more or less developed.
  B. Post-temporal bifurcate and connected with the cranium by its processes in normal manner.
    C. Body and head compressed or moderately depressed.
      D. Actinosts[7] moderate and inserted on posterior edges of hypercoracoid[8] and hypocoracoid;[9] ribs, typically, borne on enlarged parapophyses...... SCORPÆNOIDEA.
      DD. Actinosts large and partly intervening between the hypercoracoid and hypocoracoid; ribs sessile on the vertebræ.............. COTTOIDEA.
    CC. Body and head much depressed..................... PLATYCEPHALOIDEA.
  BB. Post-temporal expanded and connected with the cranium by extensive suture.
      c. Anus submedian; ventrals subabdominal; exoskeleton developed as spiniform prickles.............................. RHAMPHOCOTTOIDEA.
      cc. Anus thoracic; ventrals subbrachial; exoskeleton developed as plates arranged in about 8 longitudinal rows................ AGONOIDEA.
AA. Myodome completely wanting.................................. CYCLOPTEROIDEA.

II. Craniomi.

Teleocephali with the scapular arch abnormal, the post-temporal forming an integral part of the cranium and the postero-temporal crowded out of place by the side of the proscapula above or at the edge of the post-temporal.

---

[1] Post-temporal (Parker) = Suprascapula (Cuv.).
[2] Postero temporal (Gill, 1872) = Scapula (Cuv.).
[3] Proscapula (Gill, 1872) = Humeral (Cuv.) = Coracoid (Owen.)
[4] Intermaxillines (Gill, 1888) = Intermaxillaries (auct. pl.).
[5] Prosethmoid (Gill, 1888) = Ethmoid (auct. pl.).
[6] Myodome (Gill, 1888) = Muscular tube for ocular muscles.
[7] Actinosts (Gill, 1872) = Carpals (auct. vet.) = Brachials (Parker).
[8] Hypercoracoid (Gill, 1872) = Radial (Cuv.) = Scapula (Parker).
[9] Hypocoracoid (Gill, 1872) = Cubital (Cuv.) = Coracoid (Parker).

SYNOPSIS.

A. Myodome developed and cranial cavity open in front; prosethmoid and anteal* normally connected by suture. Infraorbital chain with its anterior bones excluded from the orbit and functional as rostrolateral, the series covering the cheeks, the third a large buccal bone articulating with the anterior wall of the preoperculum; post-temporal suturally connected with the epiotic and pterotic by inferior processes, and with the upper surface forming an integral part of the roof of the cranium; intermaxillines with the ascending pedicles atrophied and connected with the knob of the anteal by ligament. Postero-temporal contiguous to the proscapula .... TRIGLOIDEA.

AA. Myodome undeveloped, the cranial cavity mostly closed in front by expansions from the subtectals† suturally connected with corresponding expansions of the prootics and the parasphenoid; prosethmoid and anteal entirely disconnected, leaving a capacious rostral chamber opening backwards mesially into the interorbital region. Infraorbital chain, with its second and third bones crowded out of the orbital margin by junction of the first and fourth, and leaving a wide interval between the suborbitals and the preoperculum; the first very long and extending backwards, the second under the fourth and the third developed as a small special bone (pontinal) bridging the interval between the second suborbital and the antero-inferior angle of the preoperculum; post-temporal suturally connected with the posterior bones of the cranium, and with the upper surface forming a large part of the roof of the head; intermaxillines with well-developed ascending pedicles gliding into the cavity between the anteal and prosethmoid. Postero-temporal distant from the proscapula, and manifest as an ossicle on the edge of the post-temporal .... DACTYLOPTEROIDEA.‡

The superfamily SCORPÆNOIDEA includes the families *Scorpænidæ*, *Synanceidæ*, *Hexagrammidæ* (or *Chiridæ*), and *Anoplopomidæ*. The *Caracanthidæ* are generally associated with the *Scorpænidæ* and may belong to the superfamily, but this is doubtful.

The superfamily COTTOIDEA embraces the families *Hemitripteridæ* and *Cottidæ*.

The superfamily PLATYCEPHALOIDEA is represented by the families *Platycephalidæ* and *Hoplichthyidæ*. Probably *Bembras* is the type of an additional family, but I have not been able to examine its skeleton.

The superfamily RHAMPHOCOTTOIDEA is represented by one family (*Rhamphocottidæ*), with a single genus (*Rhamphocottus*), and species (*R. Richardsonii*).

The superfamily AGONOIDEA is manifested in the single family *Agonidæ*.

The superfamily CYCLOPTEROIDEA has two families, *Cyclopteridæ* and *Liparididæ*.

The superfamily TRIGLOIDEA includes the families *Triglidæ* and *Peristediidæ*.

The superfamily DACTYLOPTEROIDEA is represented only by the family *Dactylopteridæ*.

---

*Anteal (Gill, 1888) = Vomer (auct. pl.).

† Subtectal (Gill, 1888) = Orbitosphenoid (Owen).

‡ The synoptical tables were published in part in a preliminary note on "The Primary Groups of Mail-cheeked Fishes," in the American Naturalist for April, 1888 (issued about May 22), v. 22, pp. 356–358.

The *Trigloidea* and *Dactylopteroidea* are segregated as representative of a peculiar suborder CRANIOMI.

It is expected that descriptions of the several superfamilies and included families will be soon published.

Meanwhile, the reproductions of previous classifications and the comments on them will convey additional information respecting the limits of the several families and the characters which are and are not applicable to them. The following table will also indicate the families that have been admitted from time to time among the mail-cheeked fishes, with references to the pages of the works in which they were published at the dates given at the head of each column. The synonyms are extended on a line from the families of which they are homonyms, but the limits of course are various and can not be conveniently indicated in the table.

Families.	Dum., 1806.	Raf., 1810.	Risso, 1826.	Cuv., 1829.	Bon., 1832.	Bon., 1850.	Adams, 1854.	Blkr., 1859.	Gthr., 1860.	Gill, 1872.	J. & G., 1882.
Caracanthidæ										(22)	
Scorpænidæ	[1]130		[5]109				101	[9]xxi	(17)	6	650
Synanceidæ							[8]102			(22)	
Chiridæ							97	[10]xxv	(18)	6	640
Anoplopomidæ										(22)	
Hemitripteridæ										(22)	
Cottidæ							102	[11]xxiv	(19)	6	682
Platycephalidæ							102	[12]xxiv		6	
Hoplichthyidæ										(22)	
Rhamphocottidæ											
Agonidæ							102	[13]xxiv	(20)	6	722
Liparididæ								[14]xxvi	(21)	5	738
Cyclopteridæ	[2]109			[6]344	38	7	96	[15]xxvi	(21)	5	744
Triglidæ	[3]130	[4]28	109	[7]158	32	7	101	[16]xxiv	(19)	6	731
Peristediidæ									(20)		
Dactylopteridæ									(20)	(23)	(23)

[1] Cephalotes D.
[2] Plecopteres D.
[3] Dactyles D.
[4] Dactipli Raf.
[5] Scorpénides R.
[6] Discoboles C.
[7] Joues cuirassées.
[8] Synanchiidæ Ad.
[9] Scorpænoidei B.
[10] Chiroidei B.
[11] Cottoidei B.
[12] Platyc phaloidei B.
[13] Asphidophoroidei B.
[14] Gobieso oidei B.
[15] Cyclopteroidei B.
[16] Trigloidei B.
[17] Scorpænina G.
[18] Heterolepidina G.
[19] Cottidæ + Psychrolutidæ G.
[20] Cataphracti G.
[21] Discoboli G.
[22] Gill. Standard Nat. Hist., v. 3, 1885.
[23] Cephalacanthidæ or Dactylopteridæ *Gill*. Standard Nat. Hist., v. 3. p. 252, 1885.
[24] Cephalacanthidæ *Jordan*, Man. Vert. N. A., p 151, 1888.

NAMERS OF FAMILIES.

The works to which reference is made in the preceding table are as follows:

1806. Zoologie analytique, ou méthode naturelle de classification des animaux, rendue plus facile à l'aide de tableaux synoptiques; par A. M. Constant DUMÉRIL, [etc.]. Paris, Allais, libraire, Quai des Augustins, No. 39. MDCCCVI. [8vo., xxxii (+1 l.) + 344 pp.]

Families were first indicated in this work and named after supposed essential characters, *e. g.*, *Céphalotes*, *Dactylés*, *Plécoptères*.

1810. Indice d' ittiologia siciliana ossia catalogo metodico dei nomi latini, italiani, e siciliani dei pesci, che si rinvengono in Sicilia, disposti secondo un metodo

naturale [etc.]. Opuscolo del signore C. S. RAFINESQUE SCHMALTZ.—Messina. Presso Giovanni del Nobolo. Con approvazione. 1810. [8vo, 70 pp., 2 folded pl.]

Families, called orders (ordine), were recognized and chiefly named after typical genera, *e. g.*, *Percidi Scaridi.*

1826. Histoire naturelle des principales productions de l'Europe méridionale et particulièrement de celles des environs de Nice et des Alpes maritimes; par A. RISSO, [etc.]. Tome troisième.—A Paris, chez F. G. Levrault, libraire, [etc.]. 1826. [8vo.]

Most of the volume (pp. 97–480, fig. 4 on pl. 2 to fig. 50 on pl. 16) was devoted to the fishes. Various families were first instituted in this work, *e. g.*, *Scorpénides*, *Triglides.*

1829. Le Règne Animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux, et d'introduction à l'anatomie comparée, par Georges Cuvier. [2e ed.]. Paris. 1829.

1832. Saggio di una distribuzione metodica degli Animali Vertebrati di Carlo Luciano BONAPARTE, Principe de Musignano. Roma. Presso Antonio Boulzaler, 1831–32. [8vo., 86 pp.]

A translation of a part of the preceding article was soon published, viz: Versuch einer methodischen Vertheilung der Wirbelthiere mit kaltem Blut von Carl Lucian BONAPARTE, Prinz von Musignano. <Isis. 1833, col. 1183—1229.

36 families with 62 subfamilies and 15 families not subdivided (=77 subfamilies) are named and defined.

1850. Conspectus systematis Ichthyologiæ Caroli Luciani BONAPARTE. Editio reformata. 1850. Apud E. T. Brill Academiæ Typographum. [Lugduni Batavorum.] [A large sheet with names of all divisions.]

21 orders, 82 families, and 185 subfamilies are admitted.

1854. A manual of natural history for the use of travellers; being a description of the families of the Animal and Vegetable Kingdoms: [etc]. By Arthur Adams, M. R. C. S.; F. L. S.; M. R. E. S., Stettin; William Balfour Baikie, M. D., [etc.] and Charles Barron, [etc.]. London: John Van Voorst, Paternoster Row, MDCCCLIV. [12mo, viii, 749 pp.]

The families and major groups of fishes are defined by Adams (pp. 78–110).

The work is of no real value, and Swainson is regarded as an authority and subfamilies defined by him elevated to the rank of families. The only importance of the work results from the fact that the names of several families appear in it for the first time.

1859. Enumeratio specierum piscium hucusque in archipelago indico observatorum, [etc.], auctore PETRO equite a BLEEKER, [etc.]. Bataviæ, typis Langii & soc. 1859. [4°, xxxvi, 276 pp.]

1861. Catalogue of Fishes in the British Museum. By ALBERT GÜNTHER, M. A., M. D., etc. . . . Volume third. London: printed by order of the trustees. 1861. [8° (gen. title x), xxv, 586 pp.]

1872. Arrangement of the families of Fishes, or classes Pisces, Marsipobranchii, and Leptocardii. Prepared for the Smithsonian Institution. By THEODORE GILL, M. D., Ph. D. Washington: published by the Smithsonian Institution. November, 1872. (Smithsonian Miscellaneous Collections. 247.—8°, xlvi, 49 pp.)

1882. Synopsis of the Fishes of North America. By DAVID S. JORDAN and CHARLES H. GILBERT. Washington: Government Printing Office. 1883. [8°, lvi, 1018 pp.—Bull. U. S. Nat. Mus., No. 16.]

1885. The Standard Natural History. Edited by JOHN STERLING KINGSLEY. Vol. III. Lower Vertebrates, [etc.], Boston: S. E. Cassino and Company. 1885.

The authors of the ichthyological portion were S. W. Garman, Theodore Gill, D. S. Jordan, and J. S. Kingsley.

GLEANINGS AMONG THE PLEURONECTIDS, AND OBSERVATIONS ON THE NAME PLEURONECTES.

BY THEODORE GILL.

In "A Review of the Flounders and Soles (Pleuronectidæ) of America and Europe,"* President D. S. Jordan and Mr. David K. Goss have given a much-needed and masterly summary of our knowledge respecting the forms in question. With most of their conclusions I entirely agree, but there are various minor points in which I am compelled to dissent from them. One of the most important, and indeed the most important in some respects, relates to the application of the name *Pleuronectes*. For over thirty years there has been almost (but not quite) universal concurrence in restricting that name to the small-mouthed species represented by the *Pleuronectes platessa* of Linnæus. Messrs. Jordan and Goss, however, now object to such a use of the name, and revert to its employment by Fleming and DeKay for the Turbot and its relatives. Inasmuch as an almost settled question is thus again opened, and as the confusion induced by the proposed change would be considerable and deplorable, an immediate inquiry into the propriety of that view is desirable. Of course the fact that confusion would for a time result from the adoption of Messrs. Jordan and Goss's proposition is no material objection; but if the confusion can be averted without infraction of the laws of nomenclature, and renewed stability be obtained for the long current names, a not immaterial boon will have been realized for Ichthyology. A re-examination of the data involved in the question is therefore in order.

JORDAN AND GOSS'S VIEW.

Messrs. Jordan and Goss have given their reasons for the use of the name *Pleuronectes* for the Turbot and its allies in an argument which it is only just to them to reproduce. It is found in their memoir in the Annual Report of the Commissioner of Fish and Fisheries for 1886 (pp. 255, 256; Separate, pp. 31, 32):

> Our reasons for considering the Turbot as the type of the genus *Pleuronectes* may be briefly stated:
>
> In the earliest restriction of the Linnæan genus *Pleuronectes*, in which the latter name is retained for one of the subdivisions, the Turbot has been retained as the type. We therefore find ourselves compelled to transfer the name *Pleuronectes* from the small-mouthed flounders to the present group.
>
> The genus *Pleuronectes*, as it appears in the tenth edition of the Systema Naturæ, is intended to contain all flat-fishes, 18 of which are characterized and named.

*The Review was issued in advance of its appearance in the Annual Report of the Commissioner of Fish and Fisheries for 1886, with double pagination—that of the Report (pp. 225-336) and that of the Separate (pp. 1-112), and 9 plates.

Sept. 25, 1889.

Omitting foreign species, the following table shows the European species included by Linnæus, and the generic names which have since his time been specially based on each of these species:

Hippoglossus	*Hippoglossus* Cuvier, 1817.
Cynoglossus	*Glyptocephalus* Gottsche, 1836.*
Platessa	*Platessa* Cuvier, 1817; *Pleuronectes* Swainson, 1839; *Pleuronectes* Bleeker, 1862.
Flesus	*Flesus* Moreau, 1871.
Limanda	*Limanda* Gottsche, 1835.
Solea	*Solea* Quensel, 1806.
Linguatula	*Pleuronectes* Bonaparte, 1846; *Citharus* Bleeker, 1862; *Bothus* Rafinesque, 1810; *Scophthalmus* Rafinesque, 1810.
Rhombus	*Rhombus* Cuvier, 1817 (preoccupied).
Maximus	*Pleuronectes* Fleming, 1828; *Psetta* Swainson, 1839; *Passer* Valenciennes, 1855 (preoccupied).
Passer	(An abnormal specimen of *Flesus*.)

The first subdivision of the genus *Pleuronectes*, after the removal of the soles, seems to have been that of Cuvier. Cuvier subdivides the group into three subgenera, *Hippoglossus*, *Rhombus*, and *Platessa*, retaining the name *Pleuronectes* for the group as a whole, but for none of his subdivisions.

Fleming, next after him, makes use of these subdivisions, but rejecting the name of *Rhombus*, he distinctly adopts the generic name *Pleuronectes* for the "Turbot" group. His genera are, therefore, *Pleuronectes* the "Turbot," *Solea* the "Sole," *Platessa* the "Fluke," and *Hippoglossus* the "Halibut." *Pleuronectes maximus*, the "Common Turbot," is evidently intended as the type of *Pleuronectes*, as understood by him. This is, so far as we have ascertained, the first restriction of the name *Pleuronectes* to any group of flounders, and if it be so the name *Pleuronectes* must go with the Turbot and its relatives. In that case it would take the place of the preoccupied name *Rhombus* and of the prior but almost forgotten name of *Bothus*, unless we see fit to place the Turbot and the Brill in different genera, in which case *Bothus* should be used for the Brill.

The next restriction seems to be that of Swainson, in 1839, who indicates *Pl. platessa* as the type of *Pleuronectes*.

Next is the restriction made by DeKay, 1842, who again makes the Turbot the type of *Pleuronectes* by adopting the then nearly obsolete name of *Pleuronectes* in place of *Rhombus*. In 1846 Bonaparte retained the name *Pleuronectes* for a group composed of *Citharus*, *Arnoglossus*, etc. The only Linnæan species mentioned by him, *linguatula*, may be regarded as his type.

In 1862 Bleeker, and following him Günther and nearly all modern authors, have regarded *Pleuronectes platessa* as the type of *Pleuronectes*.

The reason for this view lies apparently in the fact that Artedi before Linnæus had mentioned the species later called *platessa* first in his list of species of *Pleuronectes*. This reason is now regarded as an insufficient one, and the name *Pleuronectes* must retain the signification given it by the first author, who has properly restricted it. We must therefore follow Fleming in regarding *Pleuronectes maximus* as the proper type of *Pleuronectes*.

This historical summary is not complete, and the results to which Messrs. Jordan and Goss have arrived are a consequence of the incompleteness of their review of the literature.

LINNÆAN SPECIES.

The species occurring in Europe and known to Linnæus have been correctly identified by Jordan and Goss, but a complete enumeration of

* This was published at the same time as *Limanda, i. e.*, 1835.

all the species known to the Swede may be acceptable and will show the extent of the family that his immediate successors had to deal with. As enumerated in the tenth edition of the Systema Naturæ, they are identified in the following exhibit, wherein the European species are distinguished by HEAVY TYPE, and the generic names based on them (or very near allies) are given in the right-hand column.

1.	Trichodactylus	
2.	Plagiusa	Plagusia, *Curier*, 1829.
3.	Ocellatus	Monochirus, *Rafinesque*, 1814.
4.	**HIPPOGLOSSUS**	**HIPPOGLOSSUS**, *Cuvier*, 1817.
5.	**CYNOGLOSSUS**	**GLYPTOCEPHALUS**, *Gottsche*, 1835.
6.	**PLATESSA**	**PLATESSA**, *Cuvier*, 1817.
7.	**FLESUS**	**FLESUS**, *Moreau*, 1881.
8.	**LIMANDA**	**LIMANDA**, *Gottsche*, 1835.
9.	**SOLEA**	**SOLEA**, *Quensel*, 1806.
10.	**LINGUATULA**	**CITHARUS**, *Bleeker*, 1862.
11.	Lineatus	Achirus, *Lacépède*, 1803.
12.	**RHOMBUS**	**BOTHUS**, *Rafinesque*, 1810.
13.	Dentatus	Paralichthys, *Girard*, 1859.
14.	**MAXIMUS**	**SCOPHTHALMUS**, *Rafinesque*, 1810.
15.	**PASSER**	**FLESUS**, *Moreau*, 1881.
16.	Papillosus	Syacium, *Ranzani*, 1840.
17.	Lunatus	Platophrys, *Swainson*, 1839.

The genera of true Pleuronectidæ thus referred to were proposed in the following chronological order:

1810.	Bothus, Raf.	1839.	Platophrys, Swains.
	Scophthalmus, Raf.		Psetta, Swains.
1817.	Hippoglossus, Cuv.	1840.	Syacium, Ranz.
	Platessa, Cuv.	1859.	Paralichthys, Girard.
1835.	Limanda, Gottsche.	1862.	Citharus, Bleeker.
	Glyptocephalus, Gottsche.	1881.	Flesus, Moreau.

FIRST SUBDIVISION OF PLEURONECTES.

"The first subdivision of the genus *Pleuronectes*, after the removal of the soles," does not seem "to have been that of Cuvier." Years before, Rafinesque had subdivided the genus and enumerated all the minor genera known to him.

In 1810, in his Caratteri di alcuni nuovi generi e nuove specie di Animali e Piante della Sicilia (p. 23), he proposed a new generic denomination (*Bothus*) for a portion of the genus *Pleuronectes*, but would have called it *Rhombus*, after the chief species, had not that name been already used for another genus.* He included in it, besides the "*B. rhombus* [*Pleuronectes rhombus* Lin.]," three supposed new species, *B. Rumolo*, *B. Tappa*, and *B. imperialis*. Of the three species *B. Rumolo*

*Porzione delle specie dei genere *Pleuronectes* degli autori compongono questo nuovo mio genere, il quale si dovrebbe chiamare *Rhombus* della principali delle specie che contiene, se Lacépède non avesse gia attribuito tal nome ad altro suo genere. Il nome di *Bothus* è però, un di quelle data da Aristotle di Pesci ai quest' ordine.

is the same as the Linnæan species, *B. Tappa* probably *Arnoglossus laterna*, and *B. imperialis* has been supposed to be identical with the *Arnoglossus Grohmanni*, and by Bonaparte identified with the Turbot,* but the proportions and rays assigned by Rafinesque preclude the latter.

In 1810, also, but somewhat later, Rafinesque, in his Indice d' Ittiologia Siciliana (pp. 13, 15), enumerates the Sicilian Heterosomes known to him. He considered the Heterosomes to represent the second section (i Pleurostomi) of the first division (i Giugulari) of the first subclass (i Pomniodi) of fishes, and distributed them into two orders or families, one (gli Aghirini), containing the new genus *Symphurus*, and the second (i Pleronetti) embracing the genera *Solea*, *Scophthalmus*, and *Bothus*. *Scophthalmus* was a new genus, embracing the *S. maximus* (*Pleuronectes maximus* Lin)., *S. rhombus* (*Pl. rhombus* Linn.), and *S. diurus*, a species based on the alia Passeris species of Rondelet (lib. II, cap. 8, fig. (= *Pleuronectes platessa* ?). The genus was solely distinguished by the jugular fins and caudal fin free, and eyes on the left side.†

The only difference which appears from a comparison of Rafinesque's diagnoses of *Bothus* and *Scophthalmus* is in the assumption that while there is only one ventral fin in the former there are two in the latter.‡ This assumption is baseless, as all the species referred to the two nominal genera have alike two ventrals, although very dissimilar in proportions on the respective sides. The two genera are identical, and indeed the Brill, which seems to have been at first regarded as the type of the genus *Bothus*, and is also the same as the *B. Rumolo*, is, in the later work, transferred to the genus *Scophthalmus*. The two names should therefore be regarded as strict synonyms.

But, in any case, the European species contained in the genus *Pleuronectes*, as recognized by Messrs. Jordan and Goss, were formally withdrawn from the Linnæan genus and referred to one or other of his genera by Rafinesque.

In 1815, Rafinesque in his Analyse de la Nature (Palermo), for his system of Ichthyology, classified the Heterosomes or Pleuropsia as follows:

II^e^. Sous, ord. PLEUROPSIA.

4^e^ Fam. *Pleuronectea*.

1re S.-Fam. Achiria.	2e S.-Fam. Diplochiria.
Achirus.	Pleuronectes.
Symphurus.	Scophthalmus, R.
Monochirus.	Bothus, R.
	Plagiusa.

It will thus be seen that Rafinesque had not only first eliminated the *Pleuronectes rhombus* and *P. maximus* from the mass of the Linnæan

* Bonaparte, Cat. Pesci Europei, p. 49*, s. n. *Psetta maxima*, syn. = "*Bothus imperialis, Raf. Car.* ex natur."

† "V. Gen. *Scophthalmus*. Ale giugulare, ed ala caudale sciolte, occhj alla sinistra." Raf., o. c., p. 53.

‡ "XXIII. G. *Bothus*. I due occhi alla sinistra, ale dorsale ed anale distincte e separate della caudale, una sola ale giugulare." Raf., Caratteri, p. 23.

genus, but also soon afterwards restricted the name *Pleuronectes* to a residuum left after the institution of the other genera recognized by him. Obviously, then, the generic name *Pleuronectes* should not have been retained afterward for any species of the genera first eliminated. The fact that Fleming, and later still DeKay, restricted the name to the Turbot and its kindred, in no way affects the question and is only evidence of their want of knowledge. Our attention will only be needed, then, to any proposals to restrict the name within the limits left by Rafinesque.*

BONAPARTE'S USE OF THE NAME PLEURONECTES.

In 1832, Charles Bonaparte, in his classification of the Vertebrates† (p. 117), divided the family *Pleuronectidæ* as follows:

Famiglia 24. PLEURONECTIDÆ.

289. Pleuronectes, L.		
1. Platessa, Cuv	Atl. eur. americano	‡10
2. Hippoglossus, Cuv	M. Ind. Med. Atl	10
290. Rhombus, Cuv. (*Bothus Rafin.*)	M. Ind. Med. Atl	20
1. Rhombus, Nob	M. Ind. Med. Atl	
2. Bothus, Nob	Mediterraneo. Atl	
291. Solea, Nob.		
1. Solea, Cuv	M. Ind. Med. Atl	20
2. Monochir, Cuv	M. Ind. Med. Atl	7
3. Achirus, Lacép	M. Am. Ind	4
4. Plagusia, Brown	M. Am. Ind	6

In 1833, Bonaparte, in his Fauna Italica,§ in the article on *Pleuronectes macrolepidotus*, proposed a new arrangement of the family *Pleuronectidæ* and gave the name *Pleuronectes* to a new subdivision of the old genus. The outlines of his arrangement of the family may be given in his own words:

In sei generi merita a nostro giudizio d'esser rípartíta l'intiera famiglia, e questi diremo *Platessa, Hippoglossus, Pleuronectes, Rhombus, Solea, Plagiusia;* i primi quattro constituiscono i nostri *Pleuronectini*, i rimanenti formano la sottofamiglia dei *Soleini*.

The genus *Pleuronectes* is thus limited:

Il nostro genere *Pleuronectes* ha i denti mascellari e i faringei tutti acuti. La pinna dorsale ha origine al di sopra degli occhi, oppure piu innanzi; tanto essa, quanto l'anale si prolungano fino alle coda. Il corpo è ovato-oblungo quasi scolorato da ambedue i lati pellucido. Lo scaglie grandi, caduche. L'ano s'apre nelle carena del ventre.

---

* Rafinesque's reference of his "*Scophthalmus diurus*" to that genus was simply the result of a misunderstanding. His reference of *Pleuronectes platessa* to *Solea* was an example of his general blundering proclivity.

† Saggio di una distribuzione metodica degli Animali Vertebrati di Carlo Luciano Bonaparte, Principe de Musignano. Roma. Presso Antonio Boulzaler, 1831[-1832].

‡ The numbers in the right-hand column indicate the supposed number of species of each subgenus.

§ Fauna Italica, Fasc. IV, 1833.

The species referred to this genus and illustrated by Bonaparte were *P. bosci*, *P. macrolepidotus*, *P. arnoglossus*, *P. Grohmanni*.

In 1846, Bonaparte, in his Catalogo metodico dei pesci europei (p. 47*), retained the genus with the same species, only substituting the name *P. citharus* for *P. macrolepidotus* (on account of doubt as to the identity of his species with Bonnaterre's) and adding the *P. casurus* Penn. (=*Arnoglossus laterna* J. & G.) and *P. megastomus* Donovan (=*Lepidorhombus whiff-iagonis* J. & G.).

Only the Bonapartean work of 1846 is referred to by Jordan & Goss (p. 253) in the synonymy of the genus *Citharus*. The type is said by them to be "*linguatula*, the only Linnæan species mentioned." But the name *linguatula* is not mentioned by Bonaparte either in his enumeration of the species of the genus or in the "Addenda" to his work. On the contrary, it appears that he was entirely uncertain as to the relationship of the Linnæan species, and appears to have had no idea that it belonged to his own genus called "PLEURONECTES, *Bp.* (L. *part*)" for, under the Soleine species "*Michrochirus lingula*" (p. 50*), he adds "Monochirus linguatula (Rond. 324!) *Cuv. Sw. nec* Pl. linguatula, *L. Schn.* (*Quid?*)." In other words, he wants to know what the Linnæan species is, and apparently thinks it is nearer the Soles than to *Pleuronectes*, as understood by him. Therefore Bonaparte's genus *Pleuronectes*, not containing a single one of the Linnæan species by name at least, can not be retained.

RESTRICTION OF PLEURONECTES TO P. PLATESSA.

In 1839, William Swainson in his work on the Natural History and Classification of Fishes, Amphibians, and Reptiles (Vol. II, 1839, pp. 187, 302), formally restricted the genus *Pleuronectes* to the *P. platessa* group, that species indeed being the only one mentioned by him. This use of the name was subsequently adopted by Gill (in 1861), Bleeker, Günther, and recent naturalists generally. In 1861, indeed, I had examined into the question and consulted all the authorities now mentioned with the same results as now indicated, and had used the "Genus *Pleuronectes* (Artedi) (non Bonap.)".*

That use of the name, I think, should be persisted in, and I doubt not that Messrs. Jordan and Goss will revert to the same opinion, or perhaps restrict it to a genus typified by *P. flesus*.

PROPER NAMES OF THE GENERA CALLED PLEURONECTES.

The genus to which the name *Pleuronectes* should be restricted, as already proved, is that one typified by the *P. platessa*, the one for which it has actually been employed for nearly three decades.

The genus to which the name was given by Bonaparte was subsequently divided, and to one the name *Citharus* was given by Bleeker in 1862, and the other was called *Arnoglossus* at the same time.

* Catalogue of the Fishes of the Eastern Coast of North America, p. 50.

Although *Citharus* has been used without challenge since its proposal in 1862, there are objections to its use in such connection which have been universally overlooked.

In 1838, the elder Reinhardt, in his ichthyological contribution to the Greenland Fauna,* formally used the name "*Citharus*" for a genus of Pleuronectids consisting of *Pl. platessoides* and *Pl. limandoides*, calling the former "*Citharus platessoides*, Fab."† Those fishes, he thought, ought to form a peculiar subgenus, if we would follow the principles of Cuvier, and the place of that subgenus would be between *Platessa* and *Hippoglossus*. It was distinguished by the *uniserial teeth*, which are acutely pointed, distant, and largest in front of the jaws, by the large mouth, and by the development of eight branchiostegal rays. This subgenus Reinhardt called *Citharus*, he thus availing himself of a name employed by Rondelet, but without knowing what the Mediterranean species so named was. Cuvier, he remarked, considered it to be the *Pleuronectes limandoides* which occurs in the North Sea, but (Reinhardt expressly adds) individuals from the two localities had not yet, it would seem, been directly compared.‡

The name *Citharus*, in fact, was used by Reinhardt for the species of *Hippoglossoides*, and for them alone, and the characteristics assigned to the genus as well as his remarks expressly exclude the true *Citharus* of the Mediterranean Sea. Inasmuch, then, as the Mediterranean species referred to the genus *Pleuronectes* by Bonaparte, and later as the type of the new genus *Citharus* by Bleeker, remains without a name, *Eucitha-*

---

* Ichthyologiske Bidrag til den Grönlandske Fauna, af Johannes Reinhardt.< K. Danske Vidensk. Selskabs Nat. og Math. Afhandl., v. 7, 1838, p. 130.

† Op. cit., p. 116.

‡ As the memoir of Reinhardt is inaccessible to many investigators, his remarks on Citharus are here reproduced:

Nr. 47. Det synes som, at *Pleuronectes platessoides* tilligemed *Pleuronectes limandoides Bloch* bör, naar man vil fölge de samme Grundsætninger, som have bestemt Cuvier til at danne de i hans *Règne animal* opstillede Underslægter, ogsaa danne en egen Underslægt, hvis Plads vil være imellem *Platessa* og *Hippoglossus*; denne Underslægt har ligesom *Platessa* Tænderne i Kjæverne stillede i en eneste Rad, men adskilles fra denne ved det större Gab og de meget spidse, længere fra hinanden staaende og i Kjævernes forreste Deel længere Tænder, som i begge Mellemkjævebenene sidde med regelmæssigt aftagende Længde ligened til Mundvinkelenden af disse; imedens hos *Platessa* Tænderne ere stumpe, omtrent af lige Længde, i Overkjævebenets höire Arm (paa Öiesiden af Hovedet) staae enten ingen, eller fra 2 til 4 Tænder. Denne nye Underslægt vil have det store Gab og spidse Tænder tilfælleds med *Hippoglossus*; men hos denne ere Tænderne fortil i Kjæverne stillede i flere uregelmæssige Rader og ere afvexlende i Störrelse, imedens de ere stillede i en Rad med regelmæssigt aftagende Længde hos den nye Slægt, som ved otte Straaler i Gjællehuden adskiller sig baade fra *Platessa* og fra *Hippoglossus*, hvilke, ligesom de övrige af mig undersögte Underslægters Arter kun have syv Straaler. Vi kunde kalde denne Underslægt *Citharus* efter en af *Rondelet* navngivet *Citharus asper* fra Middelhavet, som *Cuvier* anseer for at være *Pleuronectes limandoides* Bl., der findes i Nordsöen; men Individuer fra begge Localiteter synes endnu ikke at være umiddelbart sammenlignede.

rus may be hereafter used. The change necessary is thus reduced as much as the circumstances of the case admit.

Artedi, in 1738, had, it is true, referred to the *Citharus* of the ancients under the quasi-generic caption *Citharus*, and at one time I had assumed that the name might therefore be employed as the generic designation of the type; but not only is Artedi excluded as a non-binomial author, but it is evident that he did not really use the name as a generic designation, but simply quoted it as that of the species so called in ancient times, because he could not refer it to any precise place in his system.

THE GROUPS BOTHUS, PSETTA, AND LOPHOPSETTA.

Messrs. Jordan and Goss have united the Turbot, the Brill, and their American representative in a single genus, but recognize a subgenus (*Pleuronectes*) for the first, and another (*Bothus*) for the last two, although the senior author had at one time considered the "subgenera" as "genera." They have overlooked some important characters, however, in the structure of the anterior dorsal rays, the extension of the lateral line on the head, and the form of the supramaxillaries, which might have led them to a different conclusion if they had been cognizant of them. The three types are certainly closely related, and their relative degrees of affinity have been well appreciated by Messrs. Jordan and Goss. There may still be a difference of opinion whether they should be regarded as representatives of one genus or of two genera or of three genera. If, however, we apply the same criterion in ichthyology as is almost universally done in ornithology, at least among the passerine birds, the three types would properly be raised to generic rank; if even we adopt all the genera recognized by Messrs. Jordan and Goss, consistency would be best manifested in such recognition. Their superficial similarity, even, is less than that between *Citharichthys* and *Etropus* Jordan and Gilbert, as may be inferred from the fact that Messrs. Jordan and Goss failed at first to recognize any difference between two species which they subsequently referred to different genera.*

NEW GENERA.

The species which were associated by Bonaparte with the *P. macrolepidotus* (*Eucitharus linguatula*), and which were afterwards segregated by Bleeker and later writers in the genus *Arnoglossus*, may still retain that name. But two of the species referred by Jordan and Goss with doubt to that genus do not belong to it; these are the *A.* (?) *fimbriatus* and the *A.* (?) *ventralis*, known to the authors in question only from the original descriptions. These I have been enabled to study and compare with their relatives. The *A.* (?) *fimbriatus* was first described by Messrs. Goode and Bean under the name *Hemirhombus fimbriatus*, and

* *Citharichthys microstomus* was for a time referred to the genus *Etropus* and *Etropus rimosus* considered as identical with it. See Jordan and Goss's Review, pp. 54 (278) vs. 108 (332).

occurs in deep waters of the Gulf of Mexico. It was thought by Jordan and Goss to be "probably type of a distinct genus."* It actually is the representative of a hitherto undefined genus which may be named and diagnosed as follows:

CYCLOPSETTA.

Psettines with the body oblong rhombo-ovate, covered with regularly imbricated moderate cycloid scales; lateral line nearly rectilinear on both sides; snout convex; mouth very large; jaws squarely truncated behind; teeth uniserial, those of upper jaws moderate, of lower jaw enlarged and largest at sides; dorsal and anal almost symmetrical,† dorsal commencing in front of eye on snout, scarcely deflected on blind side; caudal slightly pedunculate and convex; pectorals subequal and with a subtruncate free margin; ventrals nearly equal, the left on the preanal ridge, the right lateral, both with the inner rays connected by membrane to the body; interbranchial membrane imperforate; gill-rakers tubercular and surmounted by blunt denticles.

Type *C. fimbriata*.

The scales on the eyed side are regularly cycloid with the nucleus some distance from the posterior margin and with numerous radiating striæ. The gill-rakers are quite characteristic.

The *A.* (?) *ventralis* was originally made known by Goode and Bean as the *Citharichthys ventralis*, and likewise lives in the deep parts of the Gulf of Mexico. It was considered by Jordan and Goss to be "perhaps type of a distinct genus." It is such and may receive the name of

TRICHOPSETTA.

Psettines with the body oblong, rhombo-oval, covered with adherent ctenoid scales; lateral line with an arch differentiated in front on eyed side, obscure but rectilinear on blind side; profile incurved or rectilinear; mouth large; supramaxillary bones obliquely truncated behind; teeth small, somewhat enlarged and hooked in front, uniserial; dorsal and anal symmetrical behind, dorsal commencing on snout and deflected towards right nostril; caudal subsessile and convex; pectorals very unequal, the left obtuse, the right with the second and third rays extended and filiform; ventrals both free, very unequal; the left fin on the abdominal ridge with a moderately broad base and six rays, the last of which is attached by membrane to the ridge; the right fin with a narrower base (and in the males with the inner four rays setiform, but in the female nearly similar to the left fin); interbranchial membrane imperforate; gill-rakers slender and unarmed.

---

* Jordan and Goss, op. cit., p. 332.

† Symmetrical in this connection refers to the fact that the fin is not decurved on one of the sides.

Type *T. ventralis.*

The greatest height is about the end of the first third of the length, and thence the decurvature is regular toward the eye; the scales are mostly rounded or even subtruncate and rarely angulated behind, and their marginal teeth very stout on the eyed side, but on the blind side they are regularly cycloid. The faintness of the lateral line on the blind side, the posterior truncation of the supramaxillaries, and the development of the pectorals and ventrals, especially in the males, differentiate the genus from *Arnoglossus.*

COMPARATIVE RELATIONS.

The genera just described fall into the places below indicated in Messrs. Jordan and Goss's synoptical scheme of the genera of *Psettinæ.* The following table is essentially reproduced from the memoir, the chief deviation being in the value given to the absence or presence of the pectoral fin of the blind side and the character of the teeth, whether well separated or crowded into villiform bands. The deviations are indicated by the italicized portions. The table is partially artificial and confirmation or proper allocation of the several groups awaits a comparative study of their anatomy. *Monolene*, not examined by Jordan and Goss, and considered by them to be "of uncertain relationship," is related to the genera to which it is approximated, as I have ascertained by a study of the types of both the species.

ANALYTICAL TABLE OF PSETTINÆ.

a. Septum of gill cavity between gill arches and the termination of the shoulder-girdle with a large foramen; the emargination below the shoulder-girdle near the isthmus not deep; lateral line with a strong arch in front; last rays of dorsal and anal inserted more or less on the right side of the median line; teeth subequal, in bands.

b. Vomer toothless; ventral fins free from the anal; caudal fin subsessile; scales small, each with very long spinules; vertebræ (*regius*) 10+25=35 .... PHRYNORHOMBUS.

bb. Vomer with teeth.

c. Ventral of eyed side united to the anal; scales small, very rough; body ovate; vertebræ (*punctatus*) 12+25=37. ZEUGOPTERUS.

cc. Ventral fins free from the anal; scales ciliated, deciduous; body oblong, much compressed; vertebræ (*whiff-iagonis*) 11+30=41 .... LEPIDORHOMBUS.

aa. Septum of gill cavity below gill arches, without foramen; a deep emargination nearer the isthmus; ventral fins free from anal.

d. Pectoral fin of both sides present; dorsal rays less than 100.

e. Vomer with teeth; lateral line with a strong arch in front.

f. Body elongate; scales weakly ciliated; mouth very large; teeth unequal, those of the upper jaw biserial, some of them canine-like .... EUCITHARUS.

ff. Body broadly ovate; scales small, cycloid, or wanting; teeth subequal, in *several rows;* vertebræ 31 to 36.

g. Scales obsolete or reduced in number, replaced in part by scattered bony tubercles on eyed side; dorsal with the anterior rays unbranched and well connected by membrane; vertebræ about 31 .... PSETTA.

gg. Scales well developed and regularly imbricate; dorsal with the anterior rays more or less branched, and imperfectly connected by membrane; vertebræ about 36.

gg[1]. *Lateral line developed behind lower eye; dorsal with about seven branched rays; supramaxillary squarely truncate behind and not produced at its lower angle; gill-rakers about* 4+12 .... BOTHUS.

gg[2]. *Lateral line not developed behind lower eye; dorsal with eleven to thirteen branched rays; supramaxillary obliquely truncate behind, and produced at its lower angle; gill-rakers about* 8+22 .... LOPHOPSETTA.

ee. Vomer toothless; ventral fins free from anal; caudal fin subsessile.

ee[1]. *Teeth distant and in one or two rows.*

h. Lateral line with a distinct arch in front; teeth small, uniserial, or imperfectly biserial.

i. Interorbital area a narrow ridge, sometimes with a median groove.

j. Scales *weakly ciliated* or *cycloid, deciduous; vertebræ* 10+28=38*; supramaxillaries with a posterior process from the lower angle* .... ARNOGLOSSUS.

jj. Scales strongly ctenoid, adherent; supramaxillaries obliquely truncated behind .... TRICHOPSETTA.

ii. Interorbital space more or less broad, deeply concave; scales small, ctenoid, adherent; body ovate (pectoral of left side usually filamentous in the male); vertebræ (*lunatus*) 9+30=39 .... PLATOPHRYS.

hh. Lateral line without arch in front; scales ciliated.

k. Teeth in upper jaw biserial, in the lower uniserial, the front teeth of the upper jaw enlarged; vertebræ 35 or 36 .... SYACIUM.

kk. Teeth in both jaws uniserial; interorbital space very narrow, the ridges coalescing between the eyes.

l. Mouth not very small, the maxillary more than one-third length of head.

m. Gill-rakers very short and thick, tubercle-like; scales small, firm ctenoid .... AZEVIA.

mm. Gill-rakers slender, of moderate length; scales thin, deciduous, ciliated; vertebræ 34 to 40.

mm[1]. *Head much compressed, with the interorbital region flat and level with the eye* ..... CITHARICHTHYS.

mm[2]. *Head moderately compressed, with the interorbital region sloping outwards and projecting over the lower eye* .... ORTHOPSETTA.

ll. Mouth very small, the maxillary less than one-third length of head .... ETROPUS.

hhh. Lateral line without arch in front; scales cycloid.

kkk. Teeth in both jaws uniserial, of lower enlarged and largest on sides .... CYCLOPSETTA.

ee[2]. *Teeth crowded in villiform bands* .... THYSONOPSETTA.

dd. Pectoral fin of blind side wanting; eyes very close together; caudal fin subsessile; teeth small, uniserial; mouth moderate; lateral line of eyed side arched, that of right side *less so or* nearly straight; dorsal fin beginning on snout, its anterior rays not exserted, its rays all simple and very numerous; scales small; body thin, very elongate; vertebræ (*sessili-cauda*) 43; (deep-sea flounders). MONOLENE.

SYNAPTURA, NOT BRACHIRUS.

I embrace this opportunity also to forestall the retention of the name *Brachirus* instead of *Synaptura*. Messrs. Jordan and Goss have adopted the former and given their reasons for so doing in the following words:*

> We retain the name *Brachirus* (*i. e.*, *Brachychirus*), notwithstanding the priority of the name *Brachyrus*, which seems to have the same meaning. If, however, this name of Swainson be rejected, that next in order of date is *Synaptura*, which has now the advantage of general usage.

But fortunately we are relieved from adopting that malformed name for the reason that Swainson had, on a previous page of the same work (v. 2, p. 71), applied exactly that form to the genus on a subsequent page (p. 264) designated *Brachyrus*. On the former page Swainson, comparing the subgenera of *Macrochirus* (p. 71) or *Pterois* (p. 264), remarks that "in *Brachirus* the pectorals are again shortened, and the rays connected and branched." Thus the name is first attached to the group so characterized, and can not be applied afterwards to another genus. *Synaptura* must therefore be retained, which is fortunate, as it truly "has now the advantage of general usage."

COINCIDENCE OF INCREASE OF VERTEBRÆ AND INCREASE OF LATITUDE.

Messrs. Jordan and Goss direct attention to a certain coincidence between conditions of temperature and dextrality or sinistrality of the species in the following terms:

> As the tropical *Hippoglossinæ* and all the *Pleuronectinæ* are sinistral species, the eyes and color being on the left side of the body, it follows that the tropical flounders are nearly all left-sided species, while those of arctic and antarctic waters are chiefly dextral species, the eyes and color on the right.

They then advert to the number of vertebræ in relation to conditions of temperature. They say:

> Still more curious is the relation between the number of vertebræ and the geographical distribution of the various species.
>
> It has already been noticed by Dr. Günther and others that in some groups of fishes northern representatives have the number of vertebræ increased. In no group is this more striking than in the flounders, as the following table, showing the numbers of the vertebræ in various species, will clearly show.

* Jordan and Goss, op. cit., p. 320.

Dr. Günther formulated no such generalization. What he really did was to show that the species of Labrids (and those only) living in the temperate seas had more numerous vertebræ than those occurring in the tropical waters. His words are these, referring *only to the Labridæ*:

In those genera which are composed entirely or for the greater part of tropical species, the vertebral column is composed of twenty-four, or nearly twenty-four, vertebræ, whilst those which are chiefly confined to the temperate seas of the northern and southern hemisphere have that number increased in the abdominal and caudal portions.*

There is no evidence that Dr. Günther had appreciated any further correlation in fishes generally. The context shows plainly that he did not mean to extend his generalization beyond the Labrids.

The first indication that there was a correlation among fishes generally between an increase in the number of vertebræ and increase of latitude or decrease of temperature, was published by myself in 1863,† the year after the publication of Dr. Günther's volume, in the following terms:

Dr. Günther has ennunciated for the first time a most important generalization for the Labroids which may also be extended to other families.‡ * * * * This generalization is applicable to the representatives of Acanthopterygian families generally, and can be considered in connection with the predominance of true Malacopterygian§ fishes in northern waters, fishes in which the increase in the number of vertebræ is a normal feature.

Later,|| I also remarked that "the increase in the number of vertebræ in the species of *Sebastes*, a genus peculiar to the northern seas, affords an excellent example of the truth of the generalization claiming an increased number of vertebræ for the cold-water representatives of Acanthopterygians." The case of the Sebastines became still more striking when Messrs. Jordan and Gilbert discovered that the number of the vertebræ in the species of *Sebastichthys* and *Sebastodes*, genera intermediate between the northern *Sebastes* and the tropical and subtropical representatives of the family of Scorpænids, was also intermediate.

But while claiming the generalization that there is a correlation between the increase of vertebræ and increase of latitude among fishes generally, I would not assign to it an undue value or claim for it the dignity of a law. It is simply the expression of a fact which has no cause for its being now known, if it shall ever be known. It may also be added that the generalization is true only in a general sense.

---

* Catalogue of the Fishes in the British Museum, v. 4, p. 65, note on Labridæ.

† Notes on the Labroids of the Western Coast of North America, by Theodore Gill. <Proc. Acad. Nat. Sci. Phil., 1863, p. 221.

‡ The part omitted is the paragraph already quoted from Dr. Günther's work.

§ It will be evident that the term "Malacopterygian" was used in the Cuvierian sense and applied especially to the Pleuronectids and Gadids as well as the restricted Malacopterygians of later writers.

|| Proc. Acad. Nat. Sci. Phila., 1864, p. 147.

SUBDIVISIONS.

Messrs. Jordan and Goss consider all the flat-fishes to belong to one family (Pleuronectidæ) which is divided into six subfamiles:—(1) Hippoglossinæ, (2) Pleuronectinæ [=Psettinæ], (3) Platessinæ [=Pleuronectinæ], (4) Oncopterinæ, (5) Soleinæ, and (6) Cynoglossinæ. Previously Professor Jordan had, for a time at least, adopted the families Pleuronectidæ and Soleidæ. Whether these should be reunited or still kept distinct may be regarded as an open question till an anatomical investigation has been made. The views of different authors may be learned from the following partial synonym of the two groups.

PLEURONECTIDÆ.

Synonyms as family names.

$\times$ i Pleronetti, *Rafinesque*, Indice d'Ittiolog. Siciliana, p. 14, 1810.
$<$ Pleuronectia, *Rafinesque*. Analyse de la Nature, p. —, 1815.
$<$ Poissons plats, *Cuvier*, Règne Animal, [1e éd.], t. 2, p. 218, 1817; 2e éd., t. 2, p. 237, 1829.
$<$ Pleuronectides, *Risso*, Hist. Nat. Europe mérid., t. 3, p. 245, 1826.
$<$ Pleuronectidæ, *Bonaparte*, Giorn. Accad. di Scienze, v. 52 (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 38), 1832.
$<$ Pleuronectidæ, *Bonaparte*, Nuovi Annali delle Sci. Nat., t. 2, p. 131, 1838; t. 4, p. 189, 1840.
$<$ Pleuronectidæ, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 187, 302, 1839.
$=$ Pleuronectidæ, *Bonaparte*, Cat. Metod. Pesci Europei, p. 47*, 1846.
$<$ Pleuronectidæ, *Girard*, Expl. and Surv. for R. R. Route to Pacific Oc., v. 10, Fishes, p. 145, 1858.
$=$ Pleuronecteoidei, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xv, 1859.
$<$ Pleuronectidæ, *Günther*, Cat. Fishes Brit. Mus., v. 4, p. 399, 1862.
$=$ Pleuronectidæ, *Gill*, Proc. Acad. Nat. Sci. Phila., [v. 16], p. 215, 1864.
$<$ Pleuronectidæ, *Cope*, Proc. Am. Assoc. Adv. Sci., v. 20, p. 340, 1872.
$=$ Pleuronectidæ, *Gill*, Arrangement Fam. Fishes, p. 2, 1872.
$<$ Platessæ, *Fitzinger*, Sitzungsber. k. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p 42, 1873.
$<$ Pleuronectidæ, *Jordan and Gilbert*, Syn. Fishes N. Am., p. 813, 1882.
$=$ Pleuronectidæ, *Jordan*, Man. Vertebrates North. U. S., p. 208, 1884.
$<$ Pleuronectidæ, *Jordan and Goss*, Ann. Rep. Com. Fish., etc., for 1886, p. 225, 1889.

SOLEIDÆ.

Synonyms as family names.

$>$ gli Aghirini, *Rafinesque*, Indice d'Ittiol. Sicil., p. 13, 1810.
$>$ Poissons plats, *Cuvier*, Règne Animal, [1e éd.], t. 2, p. 218, 1817; 2e éd., t. 2, p. 237 1829.
$=$ Soleidæ, *Bonaparte*, Cat. Metod. Pesci Europei, p. 50*, 1846.
$>$ Soleoidei, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xv, 1859.
$>$ Plagusioidei, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xv, 1859.
$=$ Soleidæ, ***Gill***, Proc. Acad. Nat. Sci. Phila., [v. 16], p. 215, 1864.
$=$ Soleidæ, ***Gill***, Arrangement Fam. Fishes, p. 2, 1872.
$=$ Soleidæ, *Jordan*, Man. Vertebrates North. U. S., p. 208, 1884.
Pleuronectidæ, *auct. pl.*

NOTE ON THE GENUS SPHEROIDES.

BY THEODORE GILL.

In a valuable "Review of the American species of Tetraodontidæ," published in 1886 (Proc. U. S. Nat. Mus., v. 9, p. 232), President D. S. Jordan and Mr. Charles L. Edwards have applied the name *Sphæroides* to the genus called *Cirrhisomus* or *Cheilichthys* by some preceding ichthyologists, and still more recently President Jordan has taken up a later name (*Orbidus*) for the same genus. As the last name has already enjoyed some currency (appearing in the "Manual of the Vertebrate Animals of the Northern United States," 1888, p. 170), some words are timely before its use is so established that inconvenience will result from its disuse.

The name *Sphéroïdes* was introduced into scientific literature by Lacépède in 1798, and was based on the front view of a fish which he had already described as "le *Tetrodon Plumier.*" The proposition to generically distinguish the figure was the result of sheer ignorance, oversight, and stupidity. Lacépède diagnosed the genus as follows in his "Histoire Naturelle des Poissons" (v. 2, pp. 1–22):

Les Sphéroïdes.

Point de nageoires du dos, de la queue, ni de l'anus, quatre dents au moins à la machoire supérieure.

The only species was "le *Sphéroïde tuberculé.*"

Not a single character thus assigned to the genus was pertinent to it. Almost immediately Schneider, in the "Systema Ichthyologiæ" of Bloch (Index, p. lvii), corrected the mistake of the Frenchman ("errorem Galli") and showed that the *Sphéroïde tuberculé* was based simply on the front view of the *Tetrodon Plumieri.* Far from Schneider's knowledge of that fish resting only on the work of Lacépède ("after Lacépède"), as Messrs. Jordan and Edwards assert, it was based on a critical examination of four figures of the fish derived by Bloch from Plumier, and therefrom he was enabled to correct the strange error of Lacépède. (See pp. 509, 510, and Index, p. lvii.)

It is questionable whether genera, based on such premises as were *Sphéroïdes* and some others, of the old authors, should be adopted. Surely it is inconsistent in any one to adopt such groups and refuse to adopt such as are based on well-known species.* Nevertheless, it is

*President Jordan is fond of referring to such generic names as are based on given species without accompanying diagnoses as "nomina nuda." But they are *not* "*nomina nuda,*" inasmuch as the exact information needed as to the types is given. "*Nomina nuda*" are those generic or *specific* names that are suggested without any information as to characters or any guide as to what they are meant for. If the old authors generally had specified the types of their genera and omitted "descriptions" of them, science would be a gainer.

difficult to draw a line between such as should be adopted and those that ought to be rejected. President Jordan accepts all the bad work of the old naturalists, provided that we can know what species they had in view. I have been hitherto more conservative, and have generally refused to take cognizance of such genera as "*Sphéroïdes*" and analogous ones (*e. g.*, *Tetroras*, *Etmopterus*, etc.), but am now inclined to think that the less exceptions are made to the rules of nomenclature the sooner we may have some agreement. In this case I am further influenced to accept the name *Spheroides*, inasmuch as, if we reject that, the vista of equally bad work and worse names lies before us.

But later President Jordan discovered that *Orbidus* was substituted by Rafinesque for "the French name 'Les Sphéroïdes'" in 1815, while the "Latin form *Sphæroides* was not applied until 1831" by Pillot. He therefore took up the name *Orbidus* instead of *Sphæroides* in the Proceedings of the U. S. National Museum (v. 10, p. 481) and in "A Manual of the Vertebrate Animals of the Northern United States" (5th ed., p. 170).

It may be fairly questioned whether a name derived directly from the Greek or Latin and coined especially for a given genus should not be accepted as a Latin name, even if it has a French article before it and French accents. But in the case at issue we are not called upon to consider this question. A "Latin" name was soon supplied in an unequivocal manner.

In 1806 A. M. C. Duméril published his "Zoologie Analytique," and therein he adopted the genus *Sphéroides*. In the text (p. 108) he used the word with the French accent (Les Sphéroïdes or Sphéroïde), but the index is divided into two parts, one ("table Française") containing the French names, and the other ("table Latine") the Latin names, and in the latter part (p. 342) we find the name *Spheroïdes* given as a Latin name, while in the former part (p. 328) it appears under the guise of *Sphéroïde*. According to President Jordan's views, therefore, "*Spheroides*" should be attributed to Duméril, take the date of 1806, and thus take priority of the name *Orbidus* given as a substitute in 1815.*

* The generic names originally given in French by Lacépède were Latinized by Duméril in his "Zoologie Analytique" in 1806, and thus the question whether the names derived directly from Greek, but used only in a French form, should be excluded need not be considered in his case.

A LIST OF FISHES FROM A SMALL TRIBUTARY OF THE POTEAU RIVER, SCOTT COUNTY, ARKANSAS.

BY CHARLES H. GILBERT.

The following species were taken by the writer in July last, in a small creek entering the Poteau River from the north, about 7 miles west of Waldron, Scott County, Arkansas. Three of the ten species obtained are additions to the list from the Poteau River published by Jordan and Gilbert in the Proceedings for 1886, pp. 6–10.

1. Campostoma anomalum Raf.
2. Pimephales notatus Raf.
3. Notropis heterodon Cope.

Very abundant. My specimens agree perfectly with others taken by Professor Forbes in Illinois, and by Professor Meek in the vicinity of Ithaca, New York. The snout is sharp, with terminal oblique mouth, and with the tip of the mandible black. The lateral line reaches base of caudal, but commonly skips occasional scales along its course. The teeth are two-rowed, with well defined grinding surface; and usually without serrated edges. The back is conspicuously checkered, owing to the dusky margins of the scales. Middle of sides silvery, overlaid with a blackish band which encircles the snout, and ends behind in a black spot on base of caudal. Fins, ventral region, and a narrow streak above lateral line not colored. Males with the head and anterior half of body thickly beset with small tubercles.

4. Notropis umbratilis Girard.
Very abundant.
5. Zygonectes notatus Raf.

This species is abundant both in mountain streams and in the bayous and swamps along the Arkansas and Red Rivers.

6. Lepomis humilis Grd.
Abundant.
7. Lepomis megalotis Raf.
8. Etheostoma cœruleum lepidum Girard.

Very abundant. Considerable variation in the squamation of the opercles can be observed in typical *cœruleum* from Ohio and Indiana, and specimens are not rare from these localities having the opercles with two or three scales only. The prevalence of the form with naked opercles over wide areas, makes it desirable to recognize provisionally the subspecies *lepidum*. The latter seems to be the only form found in Kansas, where it has been collected in abundance from all parts of the

Sept. 25, 1889

State by Professor Cragin. In Arkansas both forms occur, though apparently not together, and in Texas *lepidum* alone has been found.

9. Etheostoma whipplei Girard.

Abundant.

10. Etheostoma microperca Jordan and Gilbert.

Two specimens were taken. No differences were found between these and other specimens from Riverside, Indiana, with which they were compared. Both specimens had two anal spines.

UNIVERSITY OF CINCINNATI, *October* 30, 1888.

DESCRIPTIONS OF NEW BRACONIDÆ IN THE COLLECTION OF THE U. S. NATIONAL MUSEUM.

BY WILLIAM H. ASHMEAD.

For some months past, under the direction of Dr. Riley, Curator of Insects in the U. S. National Museum, it has been my pleasant duty to arrange the extensive collection of *Braconidæ* and *Ichneumonidæ* brought together from various sources by the above institution.

The collection contains not only the valuable collections of Dr. Riley and the celebrated Belfrage collection, donated by the former gentleman some years ago, but the extensive rearings of these insects made by Dr. Riley during his administration as Entomologist of the U. S. Department of Agriculture and while State Entomologist of Missouri.

The insight that these rearings give into the habits of the different species, genera, and groups into which these Hymenopters have been divided is of incalculable value, both from a scientific and economic standpoint; and the aid afforded to the systematist in classifying the complexity of forms can not be too highly estimated, and is of the greatest biological importance.

The *Braconidæ* have been but slightly studied in this country, and, naturally in such an extensive collection, many undescribed forms were discovered. These, with the exception of the Microgasters and some species in other genera, to which Dr. Riley has given especial attention, are described in the following pages.

All types of the new species described below will be found in the collections of the U. S. National Museum. I desire here to thank my friends Dr. George H. Horn and Mr. E. T. Cresson for freely permitting me to examine and make comparison with the types of these insects contained in the collection of the American Entomological Society of Philadelphia, whereby errors that might otherwise have been made have been avoided.

Subfamily BRACONINÆ.

VIPIO Latreille.

Vipio coloradensis n. sp.

Female.—Length 7^{mm}; ovipositor 9^{mm}. Orange red; ocelli, antennæ, clypeus, labrum, extreme tips of mandibles, all coxæ and trochanters, middle and posterior legs, base of mesopleura, and anterior femora at base and stripe above to near tip, black; a stripe along inner side of posterior femora, the sutures of middle and posterior knees, and extreme base of posterior coxæ, behind, are red. The head is rostriform, smooth and polished, with a slight sericeous pile; thorax smooth, polished, the mesothorax trilobed, the middle lobe being prominent; scutellum

smooth, convex and triangularly rounded behind; metathorax rounded posteriorly, smooth and polished. The abdomen is longer than the head and thorax together; the 1st segment, laterally, with broad, deep grooves, forming a broadly oval central plate; on the 2d is a large lozengoidal-shaped shield, extending almost to the tip of the segment, and laterally on each side of this shield are distinct longitudinal depressions; the 3d segment is separated from the 2d by a distinct, slightly crenulated suture; the following segments are not distinctly separated, and all are smooth and polished.

The wings when folded extend slightly beyond the apex of the abdomen; the venation as in typical species in the genus *Bracon*; there is a pale stripe across the middle of first submarginal cell and another clear spot behind the first discoidal cell.

Habitat.—Custer County, Colorado.

Described from one female specimen, sent to the Department by Mr. T. D. A. Cockerell, West Cliff, Custer County, Colorado.

This is the first species in this interesting genus to be detected in our fauna, and may at once be recognized from the Braconids by its rostriform head and peculiar color.

It might easily be mistaken for an *Agathis*, but the venation will readily separate it from that genus.

BRACON Fabricius.

Bracon agrili n. sp.

Female.—Length $7\frac{2}{5}$mm; ovipositor $2\frac{2}{5}$mm. Head, labial and maxillary palpi, antennæ, thorax, excepting metathorax, legs, and ovipositor, black; abdomen orange red.

The head and thorax are smooth, polished, covered with sericeous pile, the face densely covered, so that the sculpture can not be seen. Head almost as long as wide; a deep longitudinal groove extends from first ocellus to between the antennæ; ocelli arranged in a triangle on a rounded convex surface; antennæ very long, black, inserted on prominent tubercles, the scape not as long as the width between the eyes, the apex obliquely truncate and slightly angulated at outer side. Thorax trilobed, the middle lobe prominent; scutellum polished, rounded behind; tegulæ black, polished; the surface just beneath the insertion of anterior and posterior wings, reddish.

The wings are black with a hyaline streak across the first submarginal cell, connected with a large hyaline spot back of the posterior angle of the first discoidal cell. Abdomen broadly ovate, with the segments deeply constricted, the 2d and 3d being crenulate; on the 1st segment is a raised oval plate, on either side of which are broad, deep, lateral grooves; at the base of the 2d is a small lunate shield connected behind with a delicate longitudinal keel, the surface on either side being rugose with lines and ridges, and two broad, deep, oblique lateral grooves. Legs entirely black, covered with rather dense, long sericeous

pile; the incisions between the coxæ, trochanters, and femora more or less reddish.

The male is but $6\frac{2}{5}$mm long; it is like the female except the suture of the 5th abdominal segment as well as the 2d and 3d are crenulate; the 5th segment is abnormally shortened.

Described from three specimens, two females, one male, labeled No. 4087°, and reared from *Agrilus* on maple, April 21 and 23 and May 3, 1887.

The cocoon or pupal covering of this species is in the collection attached to a piece of maple bark. It is oval in outline, perfectly flat above and beneath, 7mm long, $2\frac{1}{2}$mm wide, and 1mm in depth, and composed of delicate silken threads, which are woven into a dense, tough, parchment-like substance.

The species approaches nearest to *B. orbitalis* Cr., but the absence of an orbital line and the structure of the abdomen will at once separate it.

Bracon Kœbelei n. sp.

Male.—Length, $4\frac{2}{5}$mm. Head, labial and maxillary palpi, prosternum, and legs, black; thorax and abdomen sanguineous. Head transverse, nearly twice as wide as long and not full behind the eyes, polished; face covered with pale sericeous hairs; antennæ 49-jointed, nearly as long as the whole insect, very gradually slenderer towards apex; scape oval, one-third shorter than the width between the eyes, the apex not dilated; joints of the flagellum, after the first, only slightly longer than wide. Thorax smooth *not* trilobed, blackish, excepting sanguineous parapsidal lines. Wings black, excepting a pale streak across first submarginal cell, connected with a large pale spot just behind the upper angle of first discoidal cell, a spot in the second discoidal cell, and the transverse vein separating the second and third submarginal cells; tegulæ black; a black spot on mesopleura directly beneath posterior wings. Legs, including coxæ, black; the sutures between coxæ and trochanters yellowish. Abdomen ovate, about as long as the head and thorax together and delicately rugose; 1st segment with an oval plate and a longitudinal keel or raised line laterally; no shield at base of 2d segment, and, while there are oblique depressions laterally on this segment, they do not form distinct grooves, as is usual in this genus; the sutures between 2d, 3d, and 4th segments are broad, distinct, and subcrenulate. The whole insect is covered with pale sericeous hairs.

Habitat.—Alameda County, California.

Described from one male received from Mr. Albert Koebele.

Bracon rugosiventris n. sp.

Female.—Length 6mm to 8mm; ovipositor 6mm to 8mm. Head, antennæ, palpi, thorax, excepting the metathorax, wings, legs, and ovipositor, black; metathorax, excepting a dusky median line and sides, and the abdomen, brownish-yellow. The head is large when viewed from above, quadrate, smooth, and polished, pilose, the hairs on face long and white;

a narrow inner red orbital line joins a wider postorbital line; the surface in front of the ocelli impressed, with a longitudinal grooved line extending from the front ocellus to the base of the antennæ; base of mandibles reddish; antennæ long, 49-jointed, the scape not as long as the breadth between the eyes, obliquely truncate at apex, the edges sharp and outwardly slightly dilated; thorax smooth, polished, the parapsides obliterated; there is a small red spot on the middle and another at posterior angles of the propleura, wanting, however, in the male; metathorax smooth, polished, the sides covered with long hairs; the venation of the wings normal, the second submarginal cell longer than the first, the first transverse cubital nervure slightly oblique; the abdomen is all very coarsely rugose with coarse irregularly raised lines, having more or less of a longitudinal direction; the plate of the 1st segment is narrowed at base, rugose, separated at sides by a deep longitudinal groove from a keel on each side, extending from base to apex of the segment, this keel itself being separated from the lateral margins of the segment by a deep groove; the second segment has a long triangular shield medially, and on either side of it about midway between it and the lateral margins another much narrower shield or keel; all the other segments are irregularly longitudinally rugose, the apical margins of which are more or less rimmed.

The male measures but 7^{mm} in length, and differs from the female as follows: The head is entirely black, without the red orbital lines; mandibles wholly black; antennæ 46-jointed instead of 49-jointed; the pleuræ are not spotted; the metathorax almost entirely black; while the sculpture of the abdomen is not quite so coarse as in the female, the two apical segments being perfectly smooth.

Habitat.—Bosque County, Texas.

Described from five females and one male in the Belfrage collection from Texas.

The peculiar rugosity of the abdomen at once separates this species from all others in our fauna.

Bracon atripectus n. sp.

Female.—Length 8^{mm}; ovipositor 8^{mm}. In stature and general appearance very similar to *B. orbitalis* Cr., only the upper portion of the mesothorax, propleura, small triangular piece of mesopleura, scutellum, a broad dorsal line on metathorax and the abdomen are sanguineous; the margins of the scutellum and the rest of the insect black. The wings have a whitish spot behind the upper angle of the 1st cubital cell, extending as a slight streak into the lower outer angle of the 1st submarginal cell. The 1st abdominal segment is sculptured as in *B. orbitalis*, but the triangular shield at base of the 2d segment is extended posteriorly into a narrow keel to near the apical margin, the tip not, however, separated from the surrounding surface; broad oblique depressions extending from the base of the shield make the basal angles

of the segment prominent; the 3d segment is also obliquely impressed, the following segments smooth.

Habitat.—Folsom, California.

Described from a single specimen, labeled Folsom, Cal., July 4, 1885.

Bracon montanensis n. sp.

Female.—Length 7^{mm}; ovipositor 3^{mm}. Yellowish red; the head, antennæ, wings, tegulæ, and legs, black. The head is smaller than in the species just described; the inner orbits very narrowly yellowish, dilated at base of antennæ, postorbital line broader; antennæ 48-jointed; the shield at base of 2d abdominal segment is large, triangular, the surface on each side wrinkled or rugose, the oblique lines not distinctly defined; the following segments all smooth, polished.

Habitat.—Montana.

Described from one specimen labeled Montana.

This species in structure also approaches near to *B. orbitalis*, but its smaller head, color, sculpture, and shorter ovipositor at once distinguish it.

Bracon alaskensis n. sp.

Female.—Length 7^{mm}; ovipositor 8^{mm}. An elongated form, the abdomen not much broader than the thorax, almost linear, and subcompressed along the venter. Head, thorax, legs, and ovipositor, black. The head is very slightly broader than long; an indistinct postorbital line, and a spot between the base of the antennæ and the eyes, red. The submarginal ridge of the prothorax, blotch on upper and lower margin of mesopleura, and dorsal surface of metathorax medially, red. Abdomen slightly longer than the head and thorax together, lemon-yellow; the plate of the 1st segment narrow, the margins parallel, except just at the base, with the usual longitudinal groove and keel on each side of it; the shield of the 2d segment is long, narrow, triangular, extending almost to the apical margin, the segment without oblique grooves laterally; the 3d segment is somewhat keeled or roof-shaped; the hypopygium is long, sharp, plowshare-shaped, extending much beyond the tip of the abdomen. Wings blackish hyaline; a pale line across 1st submarginal cell, a spot back of 1st and another at apex of 2d cubital cells; the 2d submarginal cell is long and narrow, twice as long as the 1st submarginal cell.

Habitat.—Fort Yukon, Alaska.

Described from one specimen received from Mr. L. M. Turner; taken at Fort Yukon, Alaska, in 1877.

It is very distinct from any described form in our fauna.

Bracon Schwarzii n. sp.

Female.—Length, $8\frac{2}{5}^{mm}$; ovipositor, 10^{mm}. Yellowish-red; the antennæ, eyes, ocelli, palpi, three terminal joints of anterior tarsi, middle and posterior tarsi, wings, and ovipositor, black. The parapsidal

grooves are distinct, punctate at bottom, lateral sutures of mesonotum, black; metathorax finely rugose on disk; abdomen slightly longer than the head and thorax together; the 1st segment rugose, the plate large, oval, the following segments all distinctly longitudinally striated, excepting the tip of the 4th and the following segments, which are retracted in the 4th; the 2d segment has two distinct oblique grooves at base, but no shield; the hypopygium is long, obtusely pointed, plowshare-shaped.

Habitat.—St. Catherine Island, Georgia.

Described from one specimen taken by Mr. E. A. Schwarz, April 20, 1880.

The species bears a superficial resemblance to *B. croceus* Cr., but it is larger, and the sculpture of abdomen is very distinct from that species.

(?) **Bracon arizonensis** n. sp.

Female.—Length, $3\frac{1}{5}^{mm}$; ovipositor, $2\frac{3}{5}^{mm}$. Honey-yellow; eyes, tips of mandibles, and apical portion of 3d abdominal segment, blotches on dorsal surface of the 4th, 5th, and 6th segments, and the ovipositor, black. The head is transverse, delicately shagreened, the face sparsely covered with white hairs; the thorax delicately shagreened with three distinct grooves—a median besides the parapsidals—all punctate at bottom; the scutellum is separated from the mesonotum by a broad, transverse groove, which is crenulate with delicate raised lines; the metathorax is rugose with some irregular raised lines; abdomen broadly ovate, not longer than the head and thorax together; all longitudinally striated, except the apical half of segments 3 and 4, and the following segments; all the femora are swollen, the last pair being the longest and stoutest. Wings, hyaline; stigma and veins, pale brown; the recurrent nervure is interstitial with the 1st transverse cubital, the latter oblique, the 2d submarginal cell being longer than the first along the lower margin; the submarginal cell is a little longer than the median, which would seem to place the species in the group *Exothecinæ*.

The metathorax in the male is black; otherwise it does not differ from the female.

Habitat.—Fort Grant, Arizona.

Described from three specimens, two females, one male, labeled No. 2610°, and reared July 27, 1883, from a cynipidous oak gall; collected by Mr. H. K. Morrison, at Fort Grant, Arizona.

Bracon cecidomyiæ.

Female.—Length, 3^{mm}; ovipositor, $2\frac{1}{5}^{mm}$. Honey-yellow, smooth and polished; vertex of head blackish; antennæ 32-jointed, longer than the whole insect, black, excepting the second joint, which is yellow; parapsidal grooves not sharply defined, nearly obliterated; lower portion of the mesopleura and mesosternum black; the metathorax has an impressed line down the center, the dorsal surface mostly black; abdomen ovate, the length of the thorax, lateral edges of 1st segment

rimmed, the plate smooth; all the following segments are smooth and polished, the 2d with a dorsal black blotch occupying most of its surface, leaving only the base and lateral margins yellow, the 3d, 4th, and 5th dorsally entirely black, excepting the suture between the 3d and 4th; ovipositor, black. Wings hyaline, iridescent; veins, pale brown, the stigma darker; venation as in *B. phycidis* Riley.

Habitat.—Alameda County, California.

Described from one specimen, labeled No. 3815^x, and reared January 28, 1886, from a cecidomyious gall on *Mimulus glutinosus*, taken in Alameda County, California, by Mr. Albert Koebele.

Bracon diastatæ n. sp.

Female.—Length, 2^{mm}; ovipositor, $\frac{1}{5}^{mm}$. Brownish-yellow, smooth and polished; antennæ twice the length of the whole insect, 36-jointed, black, excepting the two basal joints, which are concolorous with the body. Head large, transverse, as broad as the widest part of the thorax; parapsides not sharply defined, parallel; an irregular impression on disk of mesopleura; metathorax very short, finely rugose; abdomen ovate, the plate on 1st segment large, narrowed at base, the 2d with deep impressed lines extending from apical corners of 1st abdominal plate; other segments smooth; the very short ovipositor, black. Wings grayish hyaline, veins brown.

Described from one specimen, labeled No. 3205, and reared June 28, 1886, from a dipterous corn-leaf miner, *Diastata* sp.

Bracon gastroideæ n. sp.

Male.—Length, 3^{mm}. Head and thorax, smooth, polished, black; antennæ longer than the whole insect, 30-jointed, black, excepting the suture between the 2d and 3d joints; palpi black; head transvere, as broad as the thorax across from wing to wing; parapsidal grooves distinct, converging and almost meeting at base of scutellum; the latter with the transverse groove at base, and separated from the mesothorax by a slight ridge; mesopleura with two transverse, parallel grooves on the disk; metathorax with median and lateral keels; legs yellowish-red, tips of posterior tibiæ and tarsi, dusky; the plate of the 1st abdominal segment is oval, black, as well as the lateral grooves and keels, the lateral margins yellow; a black blotch at base of 2d segment conforming to the black plate of 1st segment. Wings, smoky hyaline; costæ and stigma, black, other veins clouded; the recurrent nervure is almost interstitial, joining the 1st submarginal cell at it lower posterior angle, the 1st transverse cubital vein oblique; the upper margin of 2d submarginal, therefore, shorter than the lower.

Described from a single specimen, labeled No. 329L^{01}, reared June 7, 1886, from *Gastroidea cyanea* Mels.

Bracon pissodis n. sp.

Female.—Length, $3\frac{1}{5}^{mm}$; ovipositor, $2\frac{2}{5}^{mm}$. Head and thorax, smooth, polished, black; antennæ about the length of the whole insect, 40-

jointed, black; the first three joints of the flagellum are only a little longer than wide and shorter than the following, the others being about twice as wide; thorax smooth without parapsidal grooves and flat in front of scutellum, the latter subconvex, elevated above the dorsal line of the mesonotum, with a transverse groove at base, the groove punctate at bottom; metathorax with a red median carina, the rest of the surface smooth and polished, black, pleura pubescent. Abdomen yellowish red; plate of 1st segment narrowed at base, the lateral keels distinct; 2d segment has a long, narrow, triangular shield medially, extending from base to apex of segment, with lateral foveæ or grooves; the whole surface of these two segments is wrinkled, the following segments smooth, polished; ovipositor yellowish, its sheaths black. Wings black, stigma and veins brown; the recurrent nervure joins the 1st submarginal cell between the middle and the apex, the first transverse cubital oblique, the 2d submarginal cell small, subtrapezoidal.

Habitat.—Penacook, New Hampshire.

Described from one specimen, reared August 19, 1886, from *Pissodes strobi*, living in Norway spruce, sent to the Department by Mr. J. Whitaker, of Penacook, New Hampshire.

Bracon bucculatricis n. sp.

Male.—Length, $1\frac{4}{5}^{mm}$. Honey-yellow; eyes, ocelli, lateral lobes of thorax, and middle lobe anteriorly, black; mesopleura, disk of metathorax, and four apical abdominal segments dorsally, dusky or brown; the abdomen is microscopically and delicately punctate. Wings hyaline, veins pale brown; the 2d cubital cell is triangular; the recurrent nervure is not interstitial, but joins the 1st submarginal cell just back of the base of the 1st transverse cubital, the latter very oblique and the 2d branch of the radius is much shorter than the 1st, making the 2d submarginal cell long, triangular.

Habitat.—Washington, D. C.

Described from one specimen, labeled "Parasite on *Bucculatrix* on oak, June 10, 1886."

The peculiar shape of the 2d cubital and the 2d submarginal cells at once distinguishes this species from all others; and these peculiarities will eventually necessitate the erection of a new genus for its reception.

Bracon xanthonotus n. sp.

Female.—Length, $2\frac{4}{5}^{mm}$; ovipositor, $\frac{2}{5}^{mm}$. Black, the surface all granulated and more or less pubescent; orbital lines, a spot on cheeks at base of eyes, and a dilated spot below base of antennæ, the legs, excepting black coxæ, and the dorsum of abdomen, excepting lateral margins, yellow; the antennæ are 24-jointed, yellowish, more or less dusky beyond apical half; abdomen ovate, the plate of 1st segment large, trapezoidal, occupying most of its surface, black, the lateral margins of this segment alone being yellow; the 2d segment is more than twice as wide as long and is slightly rugose on either side of a more or less dis-

tinct median ridge. Wings hyaline, veins pale brown, the costæ darker; venation as in *B. phycidis* Riley. The male is but $2\frac{1}{5}^{mm}$ in length and similar to the female, excepting that the abdomen is brown and the antennæ but 21-jointed.

Habitat.—San Diego, California.

Described from one male and fourteen female specimens, labeled No. 734 P°, reared from an unknown Phalænid sent to the Department by Mr. G. W. Bares, of San Diego, California.

Bracon analcidis n. sp.

Female.—Length, $3\frac{2}{5}^{mm}$; ovipositor, 2^{mm}. Pale yellowish-brown, smooth and polished; head reddish-brown, the face dusky; eyes black; antennæ 35-jointed; mesothoracic parapsides distinct; metathorax finely rugose; abdomen ovate, the three basal segments shagreened, the following segments smooth, polished; the plate of 1st segment is large, trapezoidal, margins rimmed; ovipositor black. The wings are hyaline, iridescent, veins pale brown, stigma yellowish; venation as in *B. phycidis* Riley.

Habitat.—Missouri, ? St. Louis.

Described from one specimen, labeled No. 428°, reared by Professor Riley in September, 1870, from a snout beetle, *Analcis fragariæ.*

Bracon vernoniæ n. sp.

Female.—Length, 3^{mm}; ovipositor, 2^{mm}. Yellowish-brown; eyes, ocelli, palpi, antennæ, a spot at base of anterior wings, sutures surrounding scutellum, metathoracic disk, mesopectus, plate of 1st abdominal segment, a spot at base of 2d medially, and the ovipositor, black. Head and thorax smooth, polished, parapsidal grooves distinct, although not sharply defined; antennæ long, 31-jointed; abdomen ovate, shagreened, plate of 1st segment large, trapezoidal; all tarsi and posterior tibiæ toward tips dusky. Wings dusky hyaline, veins pale brown, the costæ darker, the stigma more or less yellowish; venation as in *B. phycidis* Riley.

The male is but 2^{mm} long, all black excepting the 2d abdominal segment, which is yellow excepting a triangular spot on middle at base; the whole abdomen is smooth and polished; antennæ 26-jointed; the knees and bases of tibiæ are brown, while the wings are much darker than in the female and strongly iridescent. It may be a different species from the female, although reared from the same plant.

Described from one male and one female, labelled No. 3557°, the male reared May 18, the female May 15, 1885, from the seed capsules of *Vernonia noveboracensis;* two other males are in the collection labeled as having been reared from larvæ feeding in capsules of same plant.

The female comes nearest to *B. xanthostigma* Cress.

Bracon junci n. sp.

Male and female.—Length, 2^{mm}. Black, smooth, and polished, sparsely pubescent; inner orbits to summit of eyes, mandibles, and palid pale

yellowish; antennæ 22-jointed, black; parapsidal grooves delicately impressed, lined with pale sericeous hairs, pleura pubescent; metathorax smooth; abdomen ovate, in the female black, excepting the lateral margins of 1st segment, the plate oval, smooth, polished; ovipositor slightly exserted; in the male the lateral margins of 1st segment and the sutures of the following segments are yellowish, the dorsal portions being brownish instead of black; legs brown, tarsi dusky. The wings are hyaline, iridescent; venation as in *B. phycidis* Riley, the veins pale brown.

Described from two specimens, one male and one female, reared September 18, 1876, from *Juncus balticus*, and evidently parasitic on some dipterous larva infesting this grass.

Bracon juncicola n. sp.

Male.—Length, 2^{mm}. Honey-yellow; vertex of head and the surface back of eyes, the raised basal corners of 2d abdominal segment and the apical margins of the following segments more or less brownish; antennæ 27-jointed, black; parapsidal grooves delicately impressed, converging behind; metathorax smooth, polished; abdomen ovate; the plate of the 1st segment narrowed in front, rounded behind, the lateral margins elevated; legs pale, pubescent. Wings grayish-hyaline, veins pale brown; the recurrent nervure is almost interstitial with the 1st transverse cubital, joining the 1st submarginal cell just in front of it. The female does not differ from the male except in having a short black ovipositor not two-fifths of a millimeter long, and in the posterior tibiæ and tarsi being slightly dusky.

Described from three specimens, two males, reared September 11, 1876, from *Juncus balticus*, and one female, reared July 10, 1884, from a case bearing Tineid, probably *Coleophora*, living on *Juncus*.

In addition to the difference in color and number of joints in the antennæ there is a slight difference in the venation of anterior wings, which will at once distinguish this species from the other just described from the same plant.

Bracon pomifoliellæ n. sp.

Male.—Length, 2^{mm}. Pale honey-yellow; eyes and ocelli black; abdominal segments from the 3d inclusive, pale brown; antennæ 24-jointed, the two basal joints pale yellow, flagellum brown; parapsidal grooves delicately impressed, and meeting before reaching the scutellum; between their apices and the base of the scutellum are some large confluent punctures; the scutellum is deeply impressed at base; metathorax smooth; abdomen ovate, the sutures beyond the 3d strongly constricted; the 1st segment is slightly longer than the 2d, with deep lateral grooves, the plate thus formed being delicately longitudinally aciculated; legs pale; wings hyaline, veins yellowish, the venation as in *B. junci*, the apical margins ciliated.

Described from a single specimen, labeled No. 82^{xo1}, reared April 20, 1871, from *Bucculatrix pomifoliella* Clem.

Bracon euuræ n. sp.

Female.—Length, $2\frac{3}{5}^{mm}$; ovipositor, $1\frac{3}{5}$. Honey-yellow, smooth and polished; head, tips of mandibles, antennæ, lower margins of mesopleura, extreme apex of scutellum, postscutellum, dorsum of metathorax, plate of 1st abdominal segment at base, a quadrilateral blotch on 2d segment, and blotches occupying most of the dorsal surface of 3d and 4th segments, and ovipositor, black. Head transverse, an orbital line at summit of eyes and face, yellow; antennæ 32-jointed, slightly longer than the whole insect, 1st joint basally and the 2d joint apically, yellow; parapsidal grooves not distinctly impressed; metathorax smooth, with a slight median groove; abdomen ovate, the plate of 1st segment trapezoidal, the following segments smooth; legs concolorous with the body, the terminal joint of all the tarsi and the apex of posterior tibiæ and tarsi, except the sutures of joints, dusky. Wings hyaline, strongly iridescent, veins dark brown, excepting the costæ, median and submedian veins, which are more or less yellowish; the stigma almost black; venation as in *B. phycidis*, the 2d submarginal cell being narrowed and somewhat lengthened.

Habitat.—California.

Described from one specimen, labeled No. 3747^x, reared January 23, 1886, from a saw-fly (*Euura* sp.) found on *Salix*, sent to the Department from California by Mr. Albert Koebele.

Bracon juglandis n. sp.

Male.—Length, $2\frac{2}{5}^{mm}$. Black, smooth, and polished; vertex of head (excepting a black spot inclosing ocelli, the depressed space for reception of scape and a line running from between antennæ connected with a triangular black spot on clypeus), tegulæ, parapsidal grooves connected with a transverse line in front of the scutellum, lateral margins of 1st and 2d segments and the suture between, bright yellow; occiput, with the exceptions already mentioned and the antennæ, black. The antennæ are broken and the joints can not be counted. Metathorax smooth; the abdominal segments beyond the 2d are distinctively separated by distinct grooves, and each segment has a median dorsal impression; legs, black; tips of coxæ and trochanters, basal and apical tips of femora and the tibiæ and tarsi, yellow, the latter more or less obfuscated. Wings, dusky hyaline, paler at tips, veins brown, venation as in *B. phycidis*.

Habitat.—Los Angeles, California.

Described from one specimen, labeled No. 151^o; reared by Mr. Albert Koebele from a lepidopterous larva infesting old walnuts, at Los Angeles, California.

Bracon tortricicola n. sp.

Female.—Length, $2\frac{4}{5}^{mm}$; ovipositor, $\frac{4}{5}^{mm}$. Pale ferruginous and black; a spot inclosing ocelli connected with a line running to the base of each antenna, vertex of head, occiput, and antennæ, black; parapsidal

grooves and posterior half of middle lobe of mesonotum, posterior angles of prothorax, tegulæ, the triangular piece beneath anterior wing, mesopleura, except along the basal margin, metathorax and legs, including coxæ, pale ferruginous; metathorax smooth polished, excepting a slight median keel connected with some slight wrinkles posteriorly; abdomen ovate, delicately shagreened; the plate of the 1st abdominal segment trapezoidal, black, and connects with a black spot of the same width on the 2d, which is itself connected with broader black bands on the 3d, 4th, and 5th segments, the lateral margins of the 1st and the following segments all yellow; ovipositor, black. Wings, dusky hyaline, iridescent; veins and stigma, pale brown; venation as in *B. phycidis* Riley.

Habitat.—Kirkwood, Missouri.

Described from one specimen received from Miss Mary E. Murtfeldt, of Kirkwood, Missouri, and labeled "Parasite on Tortricid in seeds of *Ambrosia trifida*, April 28, 1885."

Bracon trifolii n. sp.

Male.—Length, $1\frac{3}{5}$ mm. Black, polished, with a fine, sparse, whitish pubescence; orbital line, lateral margins of 1st abdominal segment and the 2d, except a slight blotch medially at base, bright yellow; legs, honey-yellow. The antennæ are long, 24-jointed, black, the flagellar joints being slightly more than twice as long as wide. Parapsidal grooves are distinct, but not sharply defined or deep; the transverse groove at base of scutellum is small and not very deep; metathorax, short, smooth; abdomen ovate, smooth, the plate on 1st segment distinct; convex posteriorly, smooth. Wings, hyaline, strongly iridescent; the veins and stigma, pale brown; venation as in *B. phycidis* Riley.

Habitat.—Washington, D. C.

Described from a single specimen, labeled No. 101°, and reared June 30, 1879, from a Tineid living in the flower-heads of white clover.

Bracon atricollis n. sp.

Female.—Length, 4 mm; ovipositor, $2\frac{2}{5}$ mm. Brownish-yellow, smooth, and polished; ocelli connected with a black spot in front, tips of mandibles, antennæ, collar, mesothoracic sutures, postscutellum, metathorax excluding the metapleura, plate of 1st abdominal segment conforming to a quadrate spot on 2d, and dorsal blotches on the following segments, and ovipositor, black.

The face below the middle ocellus is microscopically shagreened; parapsidal grooves distinct; the mesopleuræ have a round fovea at the middle of the posterior margin; metathorax finely rugose, pubescent, with a short median keel anteriorly; abdomen long-ovate, very slightly longer than the head and thorax together, shagreened; plate of 1st segment trapezoidal, the posterior portion convex; legs long, slender, the posterior tibiæ one-third longer than the middle pair, the posterior tarsi being almost as long as the tibiæ; apical tibial spurs short. Wings

dusky hyaline, iridescent, veins brown, stigma yellowish; venation as in *B. phycidis*, but the 2d submarginal cell is much lengthened along its basal margin being twice as long as the 1st submarginal cell.

Described from one specimen, taken probably in Missouri. Coll. C. V. Riley.

Bracon nevadensis n. sp.

Female.—Length, $3\frac{3}{5}$mm; ovipositor, $1\frac{3}{5}$mm. Black, smooth, polished, and sparsely covered with long, sericeous hairs. The head is rather large, subquadrate; orbital line, extending into a wider streak on the cheek back of the eye, a large irregular spot above base of mandibles, clypeus and mandibles, the parapsidal grooves, tegulæ and the triangular piece in front, scutellum, mesopleuræ, metapleuræ, legs, lateral margins of 1st abdominal segment, the 2d, except a black spot back of the plate of 1st segment, the basal half of the 3d, and a slight streak at the base of the 4th widened at lateral margins, all red, or reddish-brown. The antennæ are broken at tips, but of the remaining portion, 28 joints can be counted; the flagellar joints are not much longer than wide; maxillary and labial palpi, black; parapsidal grooves not sharply defined, smooth, lined with hairs; the groove at base of scutellum crenulated; metathorax smooth, with indications of a median carina posteriorly, very hairy; mesopleuræ smooth, polished; the sternum and the middle and posterior coxæ, *beneath*, are black; there is a black streak along the under surface of the middle femora, and their tibiæ and tarsi are dusky; the 2d joint of posterior trochanters and posterior tibiæ and tarsi, are black.

The abdomen is ovate, the plate of 1st segment quadrate, roughened, keeled laterally; the 2d and basal half of 3d segments aciculated; following segments polished. Wings. dusky hyaline, iridescent, stigma and veins brown; the venation is similar to *B. phycidis*.

Habitat.—Nevada County, California.

Described from one specimen, collected by Mr. A. Koebele, September 3, 1885.

Bracon gelechiæ n. sp.

Male and female.—Length, $2\frac{1}{5}$mm; ovipositor, $\frac{3}{5}$mm. Black, subopaque, delicately shagreened and sparsely pubescent; anterior and superior orbits, lateral margins of 1st abdominal segments, and sometimes the 2d segment, except a black streak down the middle, and the 3d, 4th, and 5th segments laterally, venter, palpi, trochanters, apices of femora and tibiæ, with all the tarsi, honey-yellow.

The antennæ are 26-jointed; parapsidal grooves wanting. Wings, hyaline; veins, brown; the median transverse nervure is interstitial with the basal nervure; the 1st discoidal cell petiolate; the recurrent nervure joins the 1st submarginal cell about two-thirds its length, the 1st branch of the radius being about as long as the 1st transverse cubital nervure, which is oblique, the upper margin of the 2d submarginal cell being therefore about half the length of the lower margin.

Habitat.—Washington, D. C., and Kirkwood, Missouri.

Described from three specimens, reared October 5, 1880, from an unnamed *Gelechia* on oak, and three specimens received from Miss Mary Murtfeldt, labeled "Parasite on *Gelechia cinerella* Murtfeldt."

Bracon notaticeps n. sp.

This species in size, color, and sculpture is exactly similar to the above, only the legs are slightly paler and the antennæ are 28-jointed.

Habitat.—Washington, D. C.

Described from two specimens, labeled No. 709[a], reared from an oak-leaf skeletonizer.

Bracon Cookii n. sp.

Male.—Length, $2\frac{3}{5}^{mm}$. Head and thorax smooth, polished, black; orbits below antennæ, lower portion of cheeks, mandibles, legs, and abdomen, pale brownish yellow; the apical two-thirds of posterior tibiæ and their tarsi, excepting incisions of joints, the plate of the 1st abdominal segment, a spot on the disk of the 2d, and the disks of the 3d, 4th, 5th, and 6th segments, black, or brownish-black. The antennæ are long, cylindrical (broken at tips), the flagellar joints after the 2d are hardly twice as long as wide. The parapsidal grooves are only indicated anteriorly; the mesopleuræ are smooth with a curved line on the disk behind the middle; scutellum smooth, with a crenulate furrow at base; metathorax smooth, polished, with spiracle sulci; abdomen minutely shagreened.

Wings, hyaline; veins, brown; the venation as in *B. vernoniæ*.

Habitat.—Lansing, Michigan.

Described from a single specimen, received from Prof. A. J. Cook, labeled No. 569, "Parasite on leaf-miner on basswood."

Subfamily EXOTHECINÆ.

EXOTHECUS Wesmael.

Exothecus magnificus n. sp.

Female.—Length, 15^{mm}; ovipositor, 24^{mm}. Head, antennæ, middle coxæ and 1st joint of trochanters and the tarsi, posterior legs, wings, 4th abdominal segment and those following, and ovipositor, black; thorax, legs, three basal joints of abdomen, and two broad bands across the wings, orange red; the 2d joint of posterior trochanters and tibiæ at base, red. The antennæ about 93-jointed, extending to the middle of abdomen, the joints being broader than long; the abdomen is longer than the head and thorax together, compressed along the venter; the ventral valve prominent and obtusely rounded at apex.

Habitat.—Columbus, Texas.

Described from a single specimen, taken by Mr. E. A. Schwarz at Columbus, Texas, in July, 1879.

It is the largest and most beautiful Braconid known to me, and may be recognized at once by its beautifully banded wings.

RHYSIPOLIS Förster.

Rhysipolis carinatus n. sp.

Male.—Length, 8^{mm}. Head and thorax black, coarsely shagreened, and covered with pale sericeous hairs; abdomen, except the 1st segment, and the legs, except coxæ, ferruginous. Head short, transverse; eyes within, opposite the base of antennæ, slightly emarginate; mandibles rufous, the tips black; palpi, pale; ocelli, yellowish; antennæ, 62-jointed, black; parapsidal grooves sharply defined; scutellum with a deep transverse fovea at base; metathorax rugose with median and lateral keels; abdomen, long, the sides nearly parallel; no plate on 1st segment; the 1st and 2d segments with a longitudinal keel medially, the sculpture coarser than on the following segments, somewhat longitudinally aciculated; the other segments are smoother. Wings, hyaline, strongly iridescent, the stigma black, veins brown; the submedian cell is much longer than the median; the recurrent nervure joins the 1st submarginal between the middle and its apex, the 2d submarginal cell being subquadrate.

Habitat.—Texas.

Described from one specimen in Belfrage collection.

Rhysipolis orchesiæ n. sp.

Female.—Length, 2^{mm}; ovipositor, $\frac{2}{5}^{mm}$. Black, smooth, polished; palpi and legs, yellowish white. The antennæ are broken off at tips, two basal joints pale yellow, flagellum, black; parapsidal grooves, distinct, not, however, extending to base of scutellum; the middle lobe is delicately rugose posteriorly; side of collar, mesopleuræ, excepting a subconvex space below posterior wings, and metathorax, rugose; abdomen ovate, subpetiolated, the two basal segments longitudinally striated, the following segments smooth polished. Wings, hyaline, iridescent, veins, brown; venation as in species just described, excepting the 2d submarginal cell is trapezoidal.

Habitat.—Grand Ledge, Michigan.

Described from a single female, labeled No. 2465°, reared from a pupa of *Orchesia castanea*, taken at Grand Ledge, Michigan, July 24, 1881.

Subfamily **SPATHIINÆ.**

SPATHIUS Nees.

Spathius sequoiæ n. sp.

Female.—Length, 3^{mm}; ovipositor, $1\frac{2}{5}^{mm}$. Reddish-brown: sutures, mesopleuræ, and metathorax blackish; abdomen from the middle of 2d segment piceo-black. Head subquadrate, smooth, polished: eyes black; mandibles very small, bidentate, the teeth and tips black; antennæ long, slender, 25-jointed; thorax delicately shagreened; parapsidal grooves distinct, converging and meeting about the middle of the mesonotum, the middle lobe with a delicate longitudinal line down the

Sept. 25, 1889.

center; metathorax minutely rugulose, with two parallel longitudinal keels on the disk; legs brown, the trochanters and tarsi paler; abdomen smooth, polished, the petiole two-thirds the length of the abdomen, delicately aciculated, yellowish. Wings fusco-hyaline, clear at base and at apex, with a hyaline streak extending across the wings from the base of the stigma; veins brown.

Habitat.—Alameda County, California.

Described from two specimens received from Mr. Albert Koebele, labeled "Parasite on coleopterous larva on redwood." No date is given.

Subfamily PAMBOLINÆ.

DIMERIS Ruthe.

Dimeris rufipes n. sp.

Female.—Length, 2^{mm}; ovipositor, $\frac{2}{5}^{mm}$. Black, polished; legs, lateral margins of 1st abdominal segment, the sides and sides of the 2d segment, rufous; head subrotund, smooth, the face pubescent; mandibles red; palpi pale; antennæ 17-jointed, terminal joints of flagellum, submoniliform, the terminal joint being two and a half times as long as the preceding; parapsidal grooves distinct, converging and meeting posteriorly; the collar and metathorax rugose, the latter also areolated with the posterior angles subconic; abdomen long, subcompressed along the sides, a little longer than the head and thorax together; the 1st segment rugose, the following smooth but more or less wrinkled. Wings hyaline, veins yellowish, stigma and costæ brown; the submedian cell is much longer than the median, while the 3d cubital cell is not entirely closed.

Habitat.—Lafayette, Indiana.

Described from a single specimen received from Mr. F. M. Webster, of Lafayette, Indiana.

Subfamily DORYCTINÆ.

DORYCTES Haliday.

Doryctes longicauda n. sp.

Female.—Length, $4\frac{1}{5}^{mm}$; ovipositor, 8^{mm}. Stature and form similar to *Exothecus aciculatus* Cr., but at once recognized by the very long ovipositor and its different sculpture. Head, antennæ, legs, and the middle lobe of mesothorax, brown; the head is finely rugose, subquadrate; the whole thorax is rugose, the metathorax having a delicate median longitudinal groove anteriorly; the two basal abdominal segments are longitudinally striate, the following segments smooth and polished, although under a high power they exhibit a delicate punctuation. Wings dusky, the veins pale; the venation as in *E. aciculatus* Cr., which belongs to this group.

Habitat.—Texas.

Described from one specimen in Belfrage collection.

Doryctes incertus n. sp.

Female.—Length, 5^{mm}; ovipositor, 1^{mm}. Black; legs honey-yellow; abdomen beneath more or less rufous. Head quadrate, the vertex smooth, polished, face rugose; thorax rugose, the parapsidal grooves distinct anteriorly, obliterated posteriorly, the surface of middle lobe posteriorly depressed and coarsely rugose just in front of the scutellum; mesopleura smooth with a large groove across the disk; tegulæ yellow; metathorax finely rugose and areolated with distinct raised lines, the two basal areas large, quadrilateral; abdomen ovate, about as long as the head and thorax together, the 1st segment coarsely, longitudinally striate, the following smooth and polished; the segments of this portion of the abdomen are so finely separated that the whole surface has the appearance of one solid polished segment. Wings hyaline, very slightly dusky; the veins pale brown.

Described from a single specimen, without locality, but taken probably at Washington, D. C.

Doryctes mellipes n. sp.

Female.—Length, 5^{mm}; ovipositor, $1\frac{3}{5}^{mm}$. In stature and color this species agrees exactly with *D. incertus*, and in sculpture, excepting it is more coarsely rugose. The vertex of the head is not smooth but rugose; back of the ocelli the rugosities become transversely striate; the thorax is uniformly rugose, coarser than in *D. incertus;* the upper margin of the mesopleura beneath the wings is rugose, while the metathorax is not as distinctly areolated and the ovipositor is longer; otherwise similar.

Habitat.—Central Missouri.

Described from one specimen, labeled "Parasite from a borer in decayed cherry-wood, April 27, 1888."

Doryctes texanus n. sp.

Female.—Length, 5^{mm}; ovipositor, $5\frac{2}{5}^{mm}$. Brown; thorax black; legs rufous, the anterior and middle pairs more or less yellowish. Head transversely striate above; palpi long, pale yellowish; antennæ long, very slender, multiarticulated; thorax rugose, the parapsidal grooves distinct; metathorax slightly longer than high, rugose, with two slight keels posteriorly where the abdomen is attached; abdomen 6 jointed, shaped somewhat as in *Chelonus*, as long as the head and thorax together, rugose, the rugosities somewhat longitudinally directed on the 1st and 2d segments; the 3d and following short segments much smoother; the 1st and 2d segments comprise three-fourths of the length, the 2d being the longest; the 1st has two keels at base hardly extending to the middle of the segment, the 2d has an undulated cross-furrow beyond the middle, and another cross-furrow just back of it, between it and the apex of the segment which curves just before reaching the lateral margins and connects with the first, thus forming on the segment a transverse incised space which will readily distinguish the species;

the base of the 1st, apex of the 2d and 3d segments are more or less dusky. Wings hyaline, the stigma and veins brown; venation as in previous species.

Habitat.—Texas.

Described from one specimen. (Coll. Belfrage.)

Subfamily RHYSSALINÆ.

RHYSSALUS Haliday.

Rhyssalus atriceps n. sp.

Female.—Length, 2^{mm}; ovipositor, $\frac{2}{5}^{mm}$. Head smooth, polished, black; thorax, legs, and abdomen, pale ferruginous. Antennæ 22-jointed, basal five or six joints yellowish, beyond dusky; the 3d joint is the longest, about five times as long as wide, the following joints gradually subequal; parapsidal grooves distinct, converging and meeting before reaching the base of the scutellum, the posterior portion of the middle lobe roughened, with a slight keel medially extending to the base of the scutellum; pleura delicately shagreened; metathorax rugose, areolated; abdomen ovate, strigose, the three basal segments occupying most of the surface, the following very minute, together not longer than half the length of the 3d. Wings hyaline, veins yellowish; the submedian cell is longer than the median, the recurrent nervure interstitial with the 1st transverse cubital, the latter oblique, the second submarginal cell, therefore, subtrapezoidal.

The male differs from the female only in having the terminal abdominal segment beyond the 3d longer; together they are as long as the second segment.

Described from five specimens, two male and three female, reared August 15, 1886, from a Tortricid, *Cacœcia rosaceana* Harris.

Rhyssalus similis n. sp.

Male.—Length, $1\frac{3}{5}^{mm}$. Head and apex of abdomen, black; thorax and abdomen, reddish-brown; the 2d abdominal segment, yellow. Antennæ, 20-jointed, dusky, the basal joint yellowish; palpi, pale. The head and thorax are smooth, polished; parapsidal grooves distinct; metathorax rugose, areolated; the 1st abdominal segment and the 2d, at base, are delicately aciculated; beyond smooth; wings, hyaline; the venation as in species just described.

Described from two male specimens, labeled No. 186°, reared August 8, 1884, from an unknown larva taken on hop vine.

Rhyssalus loxoteniæ n. sp.

Male and female.—In size, sculpture, and general appearance this species is exactly similar to *R. atriceps*, only the mesothoracic lateral lobes laterally, and the middle lobe anteriorly, pleura, metathorax, the 1st abdominal segment and the small apical segments beyond the 2d are dusky or black; the 2d segment is very long, seemingly composed of the 2d and 3d soldered together, at least in one specimen this seg-

ment is partially divided by a transverse suture laterally. The two basal antennal joints, the collar, and legs are yellow; antennæ, 22-jointed; otherwise as in *R. atriceps*.

The male is similar to the female, only the 1st abdominal segment and the terminal joints beyond the 2d are black; the small apical segments have a transverse row of punctures across each segment.

Habitat.—Lafayette, Indiana.

Described from three specimens, one male, two females, labeled No. 3412°, and reared June 3, 1883, from *Loxotenia clemensiana*, a leaf-folder on wheat received from Mr. F. M. Webster, of Lafayette, Indiana.

(?) Rhyssalus selandriæ n. sp.

Female.—Length, $3\frac{2}{5}^{mm}$; ovipositor, 1^{mm}. Honey-yellow; form elongated. The head, antennæ, and ovipositor, pale ferruginous; eyes, brown. Antennæ, 31-jointed, very long and slender, about one and a half times as long as the whole insect, the flagellar joints being about six times as long as wide; parapsidal groove distinct; the scutellum with a transverse, crenulated furrow at base; metathorax smooth but delicately areolated; abdomen, ovate; the 1st and basal half of 2d, the transverse furrow across it, and the sutures of the 3d and 4th segments, longitudinally aciculated; rest of insect smooth, polished. Wings, hyaline; veins, pale yellowish; the 1st transverse cubital nervure is very delicate, almost obliterated.

Described from two female specimens, labeled, "Probably parasitic on *Selandria cerasi*, July 5, 1879." (Coll. C. V. Riley.)

Notwithstanding the three submarginal cells, this species is closely related to the genus *Hecabolus*, and the *tout ensemble* like *Cœnophanes* Förster, and it probably belongs in the group with these genera. The groups *Hecabolinæ* and *Rhyssalinæ* are separated upon very slight differences, and it would be more natural to unite them as one group.

(?) Rhyssalus trilineatus n. sp.

Male.—Length, 2^{mm}. Head, thorax, and 1st abdominal segment black; two basal antennal joints, palpi, tegulæ, and legs pale honey-yellow or yellowish white; flagellum and abdomen dusky, the latter brownish. The head is transverse, smooth, polished; mandibles pale, tips black; antennæ 21-jointed, slender, the flagellar joints of nearly equal length, about 4 times as long as wide; parapsidal grooves distinct, yellow, the middle lobe impressed posteriorly in front of the scutellum, with a central *grooved* line extending to the base of the scutellum; prothorax yellow; the scutellum has a grooved line across the base, separated into two equal portions by a raised line in the middle; metathorax rugose, with two keels down the center; abdomen ovate, the 1st segment rugose, the others irregularly wrinkled. Wings hyaline; veins pale brown; the submedian cell is longer than the median, and the recurrent nervure is not interstitial, but joins the 2d submarginal cell at its lower posterior angle.

Described from a single specimen labeled No. 2871°, reared May 14, 1883, from a case-bearing Tineid *Coleophora caryæfoliella* Clem., found on hickory.

Rhyssalus oscinidis n. sp.

Male.—Length, $1\frac{2}{5}$mm. Black, smooth, shining; lower portion of cheeks, face, palpi, legs, and 2d abdominal segment honey-yellow; antennæ long, slender, 25 jointed, the 2d joint and the flagellum dusky, the basal joint and the suture between the 2d and 3d yellow; thorax smooth, without parapsidal grooves; scutellum has a large lunate fovea at base, the bottom of which is crenulate with raised lines; metathorax rugose; abdomen oval, the 1st segment aciculated, the following smooth, polished; wings hyaline, the veins pale brown; the transverse medial nervure is almost interstitial with the basal, while the recurrent nervure is interstitial with the 1st transverse cubital; the 2d submarginal cell is twice the length of the 1st.

Habitat.—Washington, D. C.

Described from one specimen, reared July 6, 1886, from a dipterous leaf-miner, *Oscinis* sp., found on *Plantago major*.

Rhyssalus carinatus n. sp.

Male.—Length, 3mm. Head, thorax, and dorsal surface of abdomen black; two basal antennal joints, legs, sides of abdomen, and venter honey-yellow; palpi pale; flagellum of antennæ dark brown; mandibles brown, tips black. The vertex of head is smooth, polished; the face rugose, pubescent; antennæ 45-jointed, the 3d joint the longest, the 4th slightly shorter, while the following are about twice as long as wide; parapsidal grooves deep, distinct, the dorsal surface of the lobes smooth, the rest of the thorax rugose, pubescent; metathorax coarsely rugose, areolated. The abdomen is ovate, the basal segment rugose with two prominent keels, the 2d segment aciculated at base, while the following segments are smooth. Wings hyaline, iridescent, veins brown; the submedian cell is distinctly longer than the median; the recurrent nervure is not interstitial with the 1st transverse cubital nervure, but joins the 1st submarginal cell between its middle and the apex.

Habitat.—Missouri.

Described from one specimen. (Coll. C. V. Riley.)

ONCOPHANES Förster.

Oncophanes melleus n. sp.

Female.—Length, 2mm; ovipositor, about $\frac{2}{5}$mm. Pale honey-yellow; eyes, tips of mandibles, dorsal surface of metathorax, and 1st abdominal segment black. The parapsidal grooves are distinct, but do not extend to the base of the scutellum; the middle lobe has a longitudinal groove down the center, and the depressed posterior portion, in front of the scutellum, is finely punctate; the scutellum has a transverse groove at base, the bottom of which is crenulated; metathorax smooth

but areolated, the median keel quite distinct; abdomen ovate; the 1st segment is roughened, the plate distinct, narrowed at tip, the sides parallel; the other segments are smooth and more or less obfuscated. Wings hyaline, the stigma and veins pale; the 1st branch of the radius issues from beyond the middle of the stigma, the 2d branch being but slightly longer than the 1st, while the 1st transverse cubital nervure is very oblique and interstitial with the recurrent nervure; the 2d submarginal cell is, therefore, very much longer along its lower than along its upper margin.

Habitat.—Washington, D. C.

Described from four specimens, three having lost their heads and one its antennæ, reared August 24, 1884, from a small larva found on oak.

Subfamily RHOGADINÆ.

PETALODES Wesmael.

(?) Petalodes politus n. sp.

Male.—Length, 11^{mm}. Black, polished; palpi, anterior and middle legs, and posterior coxæ, trochanters and tarsi, honey-yellow; posterior femora and tibiæ rufous. Antennæ long, involute at tips, 43-jointed, the two basal joints and the two following more or less yellow, the rest black; the joints of the flagellum are a little more than four times longer than wide. The head is shaped as in the genus *Rhogas;* vertex smooth, a deep excavation in front of the ocelli; the inner orbits and face punctate, the latter rugose-punctate and pubescent; mandibles rufous at base; maxillary palpi unusually long, when extended reaching beyond the anterior coxæ, 5-jointed, the 1st annular, the 2d half the length of the 3d, dilated, especially to one side at base, the following joints long and cylindrical, the terminal joint being slightly longer than the 4th; labial palpi short, 3-jointed, not as long as the 2d and 3d joints of the maxillary palpi united, the basal joint is swollen, the other two cylindrical, the 3d being very short. Parapsidal grooves distinct, deep, converging and meeting posteriorly, the middle lobe being prominent; the collar is rugose; disks of mesopleura smooth, the margins rugose; metathorax rugose, areolated, the spiracles oval. The abdomen is long, linear, subcompressed, one and a third times longer than the head and thorax together, black, polished, the ventral surface of the 1st and 2d segments and the incisions of 3d and 4th only honey-yellow; the 1st segment above or dorsally, is depressed about the middle, deeply so laterally, and this portion is keeled to near base of segment, the apex convex; the tip of the abdomen is pubescent. Wings hyaline; the stigma and veins, more or less black, the costæ, median and submedian veins being yellowish toward their base; the submedian cell is not longer than the median and the 2d submarginal cell is trapezoidal; otherwise the venation is as in *Rhogas.*

Habitat.—Lansing, Michigan.

Described from one male specimen received from Prof. A. J. Cook. This insect shows strong affinities with *Macrocentrus*, but as the mandibles form apparently a semicircular opening, it has not been placed in that group, and is doubtfully referred to the above genus.

HETEROGAMUS Wesmael.

To this genus belong *Rh. delicatus* Cr., *Rh. fumipennis* Cr., and *Rh. texanus* Cr.

RHOGAS Nees.

Rhogas harrisinæ n. sp.

Male.—Length, $5\frac{1}{5}$ mm. Pale honey-yellow; eyes large, prominent, black, slightly emarginated opposite base of antennæ; antennæ long, very slender, 42-jointed. the flagellar joints after the 1st a little more than thrice as long as wide; metathorax delicately rugose; abdomen ovate, sessile, the 1st, 2d, and basal portion of the 3d segments longitudinally aciculated and without a central longitudinal carina, the following segments smoother, delicately punctate; wings hyaline, strongly iridescent, the costæ and stigma yellow, the median, submedian, and basal veins and the veins surrounding the 1st and 2d discoidal cells, and the 1st submarginal cell, black or very dark brown, piceous; the 2d submarginal cell is very long, trapezoidal, slightly narrowed at apex.

Habitat.—Jacksonville, Florida.

Described from one specimen sent to the Department by the writer, who reared it in October, 1881, from the larva of *Harrisina americana* Harris, taken on grape-vine.

It appears closely allied to *Rh. melleus* Cr., but is at once separated from it and from other species by the absence of the longitudinal central carina on basal abdominal segment.

Rhogas pubescens n. sp.

Male.—Length, 9mm. Similar in stature to *Rh. atricornis* Cr. Head and thorax black, rugose, covered with a rather dense white pubescence, denser on face, pleura, and metathorax; palpi, abdomen, and legs rufous, pubescent; antennæ black, 68-jointed, the joints of the antennæ being about as long as wide; metathorax rugose, with only a slight keel at base medially; the posterior femora are slightly swollen, about as in *Rh. mandibularis* Cr.; the abdomen is rugose, the rugosities on the terminal segments being finer and the surface shining; there is a distinct medial longitudinal carina on 1st and 2d segments and at the base of 3d. Wings dusky hyaline; the costæ and stigma black, the veins brown; the 2d submarginal cell is quadrate, a little longer than high.

Habitat.—Wisconsin.

Described from one specimen.

The number of antennal joints, more densely pubescent body and color, will readily separate this species from any other in our fauna.

Rhogas geometræ n. sp.

Male.—Length, $5\frac{2}{5}$mm. Very close to *Rh. rileyi*, Cr., only slightly smaller and more slender and the sculpture finer, as in *Rh. intermedius* Cr. Antennæ 50-jointed, black, the joints of the flagellum being slightly longer than wide; eyes black, subreniform; parapsidal grooves entirely wanting; metathorax with delicate median and lateral keels, the former forked at apex; a distinct longitudinal medial keel on 1st and 2d abdominal segments, becoming almost obsolete on the 3d, only traceable at base. The wings are hyaline, strongly iridescent; the 2d submarginal cell is not quite twice as long as the 1st branch of the radial; the 1st transverse cubital vein is slightly oblique and about as long as the 1st branch of the radius.

Habitat.—Missouri.

Described from three male specimens, reared from an unknown geometrid larva, May 5, 1877. (Coll. C. V. Riley.)

This species is separated from *Rh. rileyi* Cr. and *Rh. intermedius* Cr. by the absence of parapsidal grooves, different venation, and the number of antennal joints.

Rhogas platypterygis n. sp.

Male and female.—Length, 5mm. This species very closely resembles *Rh. geometræ*, agreeing in stature and sculpture; it is, however, paler or yellowish-brown, and *has distinct parapsidal grooves.* The female antennæ are but 35-jointed, pale brown, the flagellar joints hardly twice as long as wide; in male 34-jointed, the flagellar joints being thrice as long as wide; wings hyaline, strongly iridescent; veins brown excepting the costæ, median and submedian veins basally; the stigma at base and post-marginal vein are yellow; the 2d submarginal cell is more than twice as long as the 1st branch of the radius; the 1st transverse cubital nervure is straight, nearly twice as long as the 1st branch of the radius, parallel with the 2d transverse cubital nervure, but half as long again as that vein; the 2d submarginal cell is, therefore, long and narrowed apically.

Described from five specimens, one male and four females, labeled No. 2907°, reared October 23, 1883 from a lepidopteron, *Platypteryx* sp., found on alder.

Rhogas simillimus n. sp.

Male.—Length, $5\frac{2}{5}$mm. This species is almost exactly like *Rh. platypterygis*, only it is slightly darker in color. The ocelli are placed on a black spot and the antennæ are 44-jointed, black, excepting the two basal joints, the flagellar joints being almost twice as long as wide; the 1st transverse cubital nervure is about as long as the 1st branch of the radius, slightly obliquely directed; while the 2d transverse cubital nervure is only slightly shorter than the 1st; the stigma and veins are brown.

Habitat.—New Hampshire.

Described from one specimen, labeled Holderness, N. H., September, 1883. This species agrees somewhat with *Rh. fulvus*, but the eyes are emarginated directly opposite the base of the antennæ.

Rhogas nolophanæ n. sp.

Female.—Length, 5 to $5\frac{3}{5}$mm. This species in color and structure is also like *Rh. platypterygis.* The antennæ are 39 jointed, concolorous with the body, the flagellar joints being slightly more than twice longer than wide; the venation as in *Rh. simillimus*, only the stigma and veins are yellowish; the stigma is slightly dusky apically.

Habitat.—Missouri.

Described from three specimens, all females, labeled No. 41xo, and reared November 3, 1871, from *Nolophana malana* Fitch. (Coll. C. V. Riley.)

Rhogas ceruræ n. sp.

Female.—Length, $3\frac{3}{5}$mm [male 3mm]. This is still another species that could be confused with *Rh. platypterygis*, agreeing with it in color and sculpture; it is, however, slightly smaller; the parapsidal grooves sharply defined, complete; the antennae in female 32-jointed, in male 31-jointed, the flagellar joints being about twice as long as wide; the venation of the wings is exactly as in *Rh. platypterygis.*

Habitat.—California.

Described from four specimens, three females, one male, reared by Mr. Albert Koebele, in Napa County, California, from *Cerura* sp. found on willow, in August, 1887.

Subfamily CHELONINÆ.

TETRASPHÆROPYX n. g.

The whole insect is very hairy; antennæ very long, multiarticulate-thorax without distinct parapsidal grooves; metathorax short, roundedly truncate posteriorly, medially keeled; the abdomen is divided into four distinct segments, the sutures strongly constricted, the basal two segments having a delicate, central, longitudinal carina; while the 2d submarginal cell is quadrate not as long as the 1st branch of the radius.

This genus is very close to *Sphæropyx* Haliday and *Phanerotoma* Wesmael, but can at once be separated from them by the number of abdominal segments and the quadrate 2d submarginal cell.

Tetrasphæropyx pilosus Cr.

Rhogas pilosus Cress., Tran. Am. Ent. Soc., IV. p. 189.

Habitat.—Texas.

Three specimens of this rare insect, in the Belfrage collection now the property of the U. S. National Museum, convince me that Mr. Cresson was wrong in placirg this Braconid in the group *Rhogadinæ*, that it belongs with the Cryptogasters in the above group, and is the type of a new genus.

CHELONUS Jurine.

Chelonus lavernæ n. sp.

Male.—Length, $3\frac{1}{5}$ mm. Black, opaque, densely finely rugoso-punctate, covered with a short, white, sericeous pile. The palpi are pale; antennæ broken; scutellum sharply triangular; metathorax short, abruptly truncate behind, the face of the truncature slightly hollowed, the posterior lateral angles prominent, subacute; abdomen about the length of the thorax, convexly rounded off laterally and posteriorly; there is a slight indication of lateral keels, for a short distance, basally; the legs are black; the tips of the anterior and middle femora, their tibiæ and tarsi, honey-yellow; posterior legs all black except tibiæ basally. Wings hyaline, the parastigma, the stigma, and radius, black or brownish-black; other veins yellowish.

Habitat.—Kirkwood, Missouri.

Described from a single specimen labeled "Parasite on *Laverna eloisella* Clem., October 18, 1881," received from Miss M. E. Murtfeldt.

Chelonus pallidus n. sp.

Female.—Length, $3\frac{3}{5}$ mm. Head, antennæ, dorsum of mesonotum, postscutellum, posterior coxæ and apical tips of femora, and tips of tibiæ black; scape of antennæ, beneath, mandibles except tips, palpi, collar, pleura, scutellum, metathorax, and abdomen honey-yellow. The head is transverse, finely punctate, delicately, transversely aciculated on occiput; thorax rugose, with distinct coarser rugosities on the disk of mesonotum; metathorax rugose; there are two prominent, subacute projections just above where the abdomen joins the thorax, and the lateral posterior angles are very prominent. Wings hyaline; the stigma and veins blackish.

Habitat.—Maryland.

Described from a single specimen, labeled No. 3372°, reared June 2, 1884, from a *Chlorops* on wheat, sent to the Department by Mr. A. H. Carson, of Hernwood Farm, Church Hill, Queen Anne's County, Maryland.

Chelonus nigripennis n. sp.

Male.—Length, $2\frac{4}{5}$ mm. This is a short, stout, intensely black, opaque species, with a coarse, dilated, reticulated punctuation on thorax, pleura, and abdomen, the sculpture of the abdomen being, however, longitudinally directed. The head is finely sculptured, coarser on face; mandibles rufous, tips black; palpi dusky; antennæ 20-jointed; scutellum coarsely rugoso-punctate; metathorax abruptly truncate behind, the lateral posterior angles very prominent; the short dorsal surface is medially keeled and there are some more or less distinct raised lines laterally. The abdomen is well rounded posteriorly, bicarinate basally, very rugose; from the hollow beneath, at the tip, project two hairy appendages. Wings blackish-fuscous; the costæ, stigma, and parastigma,

black; the other veins dark brown; the 1st branch of the radius is about one and a half times longer than the 2d branch.

Habitat.—Washington, D. C.

Described from one specimen.

ASCOGASTER Wesmael.

Ascogaster flaviceps n. sp.

Female.—Length, $4\frac{1}{2}$ mm. Head, palpi, two basal joints of antennæ, and legs, honey-yellow; flagellum, thorax, and abdomen, black. The head is finely confluently punctate; antennæ 27-jointed, involuted at tips, the scape long, a little longer than the 1st joint of the flagellum; the latter is about five times as long as wide; thorax confluently punctate, the posterior surface of middle lobe, rugose; the parapsides are not distinct, only indicated by some punctures; metathorax rugose, sloping posteriorly with two short, acute carinæ on the disk, and acute lateral angles posteriorly; the abdomen is as long as the head and thorax together, gradually narrowed posteriorly, the tips roundedly truncate, the whole surface being uniformly rugose, with two moderately long keels basally. Wings hyaline, iridescent; stigma and veins brown; the parastigma and the base of the median and anal nervures yellowish; the 1st discoidal cell is distinctly separated from the 1st submarginal, and the recurrent nervure is interstitial with the 1st transverse cubital nervure, the 2d transverse cubital being very pale or hyaline.

Habitat.—Texas.

Described from one specimen in Belfrage collection.

Subfamily SIGALPHINÆ.

SCHIZOPRYMNUS Förster.

Schizoprymnus texanus Cress.

Sigalphus texanus Cress.

Three specimens of this species, labeled No. 216^{01}, were reared May 22, 1880, from a gall, *Trypeta solidaginis*, from which also issued beetles, (*Mordellistena unicolor* Leconte); other specim ns that can not be separated are numbered 2493^{01}, and were reared December 13, 1881, from a Trypeta gall sent to the Department by Mr. H. K. Morrison, collected in Utah.

Schizoprymnus americanus n. sp.

Female.—Length, 6mm. Black; confluently punctate, sparsely pubescent. The abdomen is one solid carapace (although two, more or less distinct, oblique sutures can be detected laterally), one-third longer than the head and thorax together, brown, pubescent. Head transverse; a sharp keel extends from first ocellus to between the antennæ; clypeus sunken, with deep foveæ on each side; mandibles black; palpi pale; antennæ reach to apex of metathorax; parapsidal grooves are

indicated posteriorly, obliterated anteriorly; scutellum convex, rather smooth dorsally, with large, deep foveæ at base; metathorax short, with lateral carinæ, a slender, sharp spine in the middle on the superior edge of the truncature, and the posterior lateral angles are prominent, *laminate*, superiorly deeply impressed; legs rufous, all the coxæ black; the extreme tips of posterior tibiæ and tarsi more or less dusky. The abdomen is uniformly rugose without basal carinæ, and with a deep vertical, longitudinal sulcus at apex; the raised rim surrounding the venter is very prominent, abruptly broken opposite the insertion of the ovipositor and subacute; the ovipositor is slightly exserted, as long as the basal joint of hind tarsi. Wings dusky hyaline; costæ and stigma black; veins brown; there are but two submarginal cells, and the 1st submarginal is distinctly separated from the 1st discoidal.

Habitat.—Texas.

Described from a single specimen in the Belfrage collection. The European type of this genus is *Sigalphus obscurus* Nees. Mr. Marshall does not include it in his tables of the *Sigalphinæ*, probably because it is not found in England, but the genus seems to be founded upon good, distinctive characters, and I believe it should be recognized.

UROSIGALPHUS n. g.

This genus is at once distinguished from *Schizoprymnus* by the submedian cell being much longer than the median; the antennæ 16-jointed; abdomen oval, highly convex, and without a trace of a suture, the apex without a distinct sulcus; the ovipositor is distinctly exserted; in one species it is nearly twice the length of the insect; the apex of the abdomen in the male is armed with two porrect spines, the genital claspers being long, pendulous, and hairy; metathorax, in both sexes, is short, obliquely truncate behind, the superior edge being distinctly margined, the posterior lateral angles not at all prominent, while the posterior femora are quite robust, or somewhat swollen. (Type: *Urosigalphus armatus.*)

Urosigalphus armatus n. sp.

Female.—Length, $6\frac{2}{5}$mm; ovipositor, 10mm. Black, subopaque, coarsely punctuate and rugose, covered with a sparse, white pubescence, denser on face and abdomen.

Head transverse, punctulate, some of the punctures confluent on vertex; the stemmaticum is subpyramidal, three-angulated, the ocelli placed at the base of each face; antennæ 16-jointed, black, reaching to the base of the abdomen, the four or five basal joints of flagellum being about five times as long as wide; thorax punctate, the parapsidal grooves obliterated and their place filled with coarse, dilated, reticulated punctures; scutellum rounded off posteriorly and reticulated with coarse punctures; metathorax short, roughened with coarse, reticulated punctures, obliquely truncate behind, the superior edge of the truncature

being distinctly margined, the face having two keels; abdomen oval, rugose with coarse, reticulated punctures, the raised lines of which are longitudinally directed, the apex rounded; ovipositor exserted, very long, the whole base projecting below the abdomen, possibly abnormally so from an injury; legs, including coxæ, rufous, the posterior tibiæ and tarsi black, their femora swollen. Wings dusky hyaline, the costæ and stigma black; other veins dark brown; the submedian cell is much longer than the median; the 1st discoidal cell is distinctly separated from the 1st submarginal; the recurrent nervure joins the 1st submarginal cell a little beyond the middle, the 1st branch of the radius being slightly shorter than the 1st transverse cubital nervure.

The male is only 6^{mm} long, colored and sculptured as the female, but is at once distinguished from it by the two porrect spines at apex of abdomen, the absence of the ovipositor, and the projecting genital tubercles or claspers.

Habitat.—Tennessee.

Described from two specimens, one male and one female.

Urosigalphus robustus n. sp.

Female.—Length, 4^{mm}. Black, very coarsely punctate; the abdomen sculptured as in *C. sericeus* Say; palpi brown; antennæ black (broken); the scutellum and disk of mesonotum are roughened with coarse, dilated, reticulated punctures; the metathorax as in previous species; legs honey-yellow; coxæ black; the posterior femora stout, swollen; the abdomen is not as long as the head and thorax together, oval, full, with a slight sulcus at apex beneath; the sculpture is coarse, the raised lines longitudinally directed; no keels at base, the ovipositor slightly exserted; wings blackish; costæ and stigma black; venation as in *U. armatus.*

Habitat.—Virginia.

Described from one specimen.

Subfamily AGATHIDINÆ.

PARAGATHIS n. g.

This genus is founded upon *Microdus thoracicus* Cress., and is intermediate between *Microdus* and *Agathis.*

The form is robust, the head not rostriform, although the tongue is very much elongated, bee-like, the length of the head, the apex bilobed, the maxillary and labial palpi both being 5-jointed; the basal joint of the posterior tarsi are stout, slightly flattened; antennæ 30-jointed, the flagellar joints after the 8th not longer than wide; venation as in *Agathis.*

Paragathis thoracicus Cress.

Microdus thoracicus Cr., Trans. Am. Ent. Soc., IV, p. 181.

MICRODUS Nees.

Microdus grapholithæ n. sp.

Female.—Length, $4\frac{4}{5}^{mm}$; ovipositor, 4^{mm}. An elongated, slender form, honey-yellow; eyes purplish; antennæ black above, yellow beneath; tarsi, except the last joint, white; the posterior femora have a black spot above at apex, their tibiæ and spurs white, the former with a black spot on upper surface at base and the apex black; the tarsi black, the 1st joint at base and the following joints ringed with white; metathorax rugose with lateral keels and two parallel keels on the disk; abdomen long, linear, slightly longer than the head and thorax together, smooth, polished, the segments hardly distinguishable; ovipositor black; wings hyaline; costæ and stigma black; veins yellowish; the areolet triangular; the cubitus or the vein separating the 1st discoidal and 1st submarginal vein is not entirely obliterated, the basal portion remaining, so that while the 1st submarginal and 1st discoidal cells are confluent they are partially separated.

The male agrees with the female structurally, only the head is brownish on vertex; the disk of metathorax, 1st abdominal segment, and the apex of the abdomen black.

Habitat.—Kirkwood, Missouri.

Described from two specimens, one male and one female, received from Miss Mary E. Murtfeldt, labeled "Parasite on *Grapholitha malachitana* Zell."

The species seems to be nearly related to *Microdus pallens* Cress.

Microdus albocinctus n. sp.

Female.—Length, $5\frac{3}{5}^{mm}$; ovipositor, 4^{mm}. Polished black; antennæ involuted at tips, brown, the scape basally and the apex of the 2d joint yellowish; mandibles and palpi white; mesopleura, metapleura, and legs honey-yellow; the posterior legs are annulated with white and marked as in previous species; the cheeks superiorly are angularly produced posteriorly, a peculiarity never noticed in other species, and may prove to be a deformation in this one. The parapsidal grooves are deep, punctulate at bottom; pleura very hairy; metathorax rugose with some raised lines; abdomen linear, as long as the head and thorax together, all shining, but the 1st segment is delicately longitudinally aciculated, and the 2d segment delicately shagreened. Wings hyaline; costæ and stigma dark brown; the other veins paler; venation normal.

Habitat.—Kirkwood, Missouri.

Described from a single specimen labeled "Parasite on a Tortricid on chestnut, June 20, 1886."

Seems to be allied to *Microdus annulipes* Cress., but the wholly black abdomen and its sculpture will at once separate it.

Microdus aciculatus n. sp.

Male and female.—Length, 4 to $4\frac{4}{5}^{mm}$; ovipositor, 4^{mm}. Black, polished, sparsely punctulate; antennæ, palpi, and legs, excepting tibial spurs

and sutures of joints, entirely black; the parapsidal grooves deep; metathorax rugose, without keels; the abdomen varies from a dark red more or less suffused to yellowish-red; in one specimen the apex is entirely black; the 1st and 2d segments, and the 3d segment for more than half its length are longitudinally aciculated, the following segments are smooth; the 2d and 3d segments are divided into two parts by a distinct transverse groove; ovipositor black; wings black; stigma and veins dark brown. The male does not differ structurally from the female.

Habitat.—Texas.

Described from six specimens, one male and five females, in Belfrage collection.

ORGILUS Haliday.

Orgilus terminalis n. sp.

Male.—Length, 7^{mm}. Sanguineous, smooth, polished; antennæ, palpi, scutellum, and metathorax dorsally, wings, anterior and middle coxæ and trochanters, a streak above on middle tibiæ, apex of posterior tibiæ, all tarsi, and the terminal abdominal segments from the 4th inclusive, black. The parapsidal grooves are deep with punctures at bottom; all sutures punctulate; the mesopleura with a crenulated sulcus across the disk; metathorax rugose; abdomen longer than head and thorax together, perfectly smooth, polished, except the 1st segment, which is finely aciculated. The 1st discoidal cell is separated from the 1st submarginal cell, the areolet subobliterated, the 1st transverse cubital nervure being very long, more than thrice as long as the 1st branch of the radius.

Habitat.—Colorado.

Described from one specimen.

Orgilus Rileyi n. sp.

Female.—Length, 7^{mm}. Sanguineous; the head, palpi, antennæ, prosternum, mesosternum, mesopleura, metathorax, anterior and middle legs and the trochanters and tibiæ and tarsi of the posterior legs, black.

The head when viewed from in front is triangular, antero posteriorly rather thin, the face finely punctulate, slightly ridged in the middle, pubescent; clypeus transverse, smooth, polished, subconvex; mandibles long, black, sickle-shaped, with two teeth at apex, one smaller and shorter than the other; sides of collar, pleura and metathorax rugose; the mesopleura has a large furrow across the disk; abdomen smooth, polished; the ovipositor very short, not longer than the 3d joint of posterior tarsi, black. Wings black with a large irregular, white spot in 1st submarginal cell and extending below the areolet and back of the 1st discoidal cell; the areolet is rather large, the bounding veins forming almost a perfect quadrate cell.

Habitat.—Unknown, probably Missouri.

Described from a single specimen in the Riley collection.

Subfamily EUPHORINÆ.

PERILITUS Nees.

Perilitus gastrophysæ n. sp.

Female.—Length, $2\frac{3}{5}^{mm}$; ovipositor, $\frac{4}{5}^{mm}$. Polished; stemmaticum, antennæ, thorax, and abdomen, black; head and legs red. Antennæ 22-jointed; palpi yellowish; parapsidal grooves distinct, converging, but not meeting posteriorly, the middle lobe thus formed posteriorly or just in front of the scutellum is slightly depressed, punctulate; scutellum triangular, with a deep transverse groove at base; metathorax rugose, with some raised lines; abdomen petiolated, the petiole dilated at apex, longitudinally aciculated, and more or less reddish basally. Wings hyaline, veins brown; the 1st discoidal and 1st submarginal cells confluent, the marginal cell semicordate; the submedian cell is slightly longer than the median.

Habitat.—Washington, D. C.

Described from two specimens, labeled No. 329 L°, reared May 31 and June 26, 1886, from *Gastrophysa cyanea.*

WESMAELIA Förster.

Wesmaelia Rileyi n. sp.

Female.—Length, $2\frac{1}{5}^{mm}$. Black, smooth, polished; ocelli, two basal joints of antennæ, and legs yellowish; the abdomen more or less piceo-black. The head is transverse, much wider than the thorax; antennæ 13-jointed, the two basal joints globular and of nearly the same size; thorax ovoid, short; the mesonotum convex, smooth, without parapsidal grooves; collar not apparent; tegulæ and surrounding surface yellow; scutellum convex, smooth, polished, with a deep transverse groove at base; metathorax areolated; the legs are very long, slender, the hind pair being much longer than the others; the middle femora are much longer than their tibiæ, the latter but slightly longer than the tarsi, with a single apical spur; the posterior coxæ are lengthened, cylindrical; the femora and tibiæ of about equal length, the latter with two apical spurs, the tarsi but slightly shorter than the tibiæ, the basal joint being thickened and as long as all the other joints combined.

Abdomen long, subcompressed, shaped very much as in the ophionid genus *Limneria*, the 1st and 2d segments forming a long petiole, the 2d being slightly longer than the 1st; the ovipositor is short. Wings hyaline, veins brown; the marginal cell is long, lanceolate; the radius has but two branches, the 1st forming a right angle with the 2d; the 1st submarginal and the 1st discoidal cells confluent, rhomboidal; the submedian cell being slightly shorter than the median.

Described from six specimens in the Riley collection.

This remarkable insect agrees with the definition of this genus, but seems out of place in the group, and more closely allied with the group *Aphidiinæ*, where it may ultimately be placed.

Subfamily METEORINÆ.

METEORUS Haliday.

Meteorus coquilletti n. sp.

Male.—Length, $3\frac{2}{5}$mm. Pale yellow ferruginous, shining, covered with fine, short pubescence; eyes purplish-brown; stemmaticum black; antennæ very long, slender, dusky towards tips; metathorax finely rugose with a delicate carina down the center; abdomen polished, the 1st segment longitudinally aciculated. Wings hyaline, iridescent; the stigma and veins pale yellowish; the 2d branch of the radius is a little longer than the 1st, but one-third shorter than the 2d branch of the cubitus, the 2d submarginal cell is therefore much shorter than wide, and not quadrate.

Habitat.—Los Angeles, California.

Described from two specimens, received from Mr. D. W. Coquillett, labeled "Bred from *Agrotis* sp. (?) July 3."

It is closely allied to *M. communis* Cress., but is smaller, and the shape of the 2d submarginal cell will distinguish it.

Meteorus œcopsidis n. sp.

Male.—Length, $4\frac{1}{5}$mm. Pale yellow ferruginous, covered with a short, sericeous pubescence; eyes large, purplish-brown, with decided violet reflections in certain lights, and converging toward each other basally, stemmaticum more or less black; palpi pale; antennæ long, 29-jointed, dusky apically, the joints of the flagellum about three and one-half to four times as long as wide; parapsides obliterated, the mesonotum being a solid piece; metathorax minutely rugose, the disk dusky; no carina; abdomen normal, the 1st segment coarsely aciculated, the post-petiole black; the 3d segment is also more or less black, piceo-black posteriorly. Wings hyaline; veins pale yellowish brown; the 2d branch of the radius is about one-third longer than the 1st, and half the length of the 1st transverse cubital nervure, the latter oblique, the 2d transverse cubital nervure being slightly shorter but parallel with it; the 2d submarginal cell is, therefore, twice as wide as long; the submedian cell is as much longer than the median as the length of the transverse median nervure.

Habitat.—Washington, D. C.

Described from a single specimen, labeled "Parasite on *Œcopsis*, August 10, 1888."

This species is also allied to *M. communis* Cress., in stature and color, but the smoothness of the mesonotum, the length of the submedian cell, and the shape of the 2d submarginal cell at once separate it.

Meteorus floridanus n. sp.

Male.—Length, $3\frac{1}{5}$mm. The general color is paler than in the previous species, but the antennæ are 32-jointed, the flagellum dark-brown, the stemmaticum black, the lateral lobes of mesonotum and the dorsal surface of abdomen more or less black; the base of the petiole yellow,

the 2d abdominal segment also yellowish in the middle and along the basal suture. Wings hyaline, iridescent; the venation is similar to *M. œcopsidis*, only the 1st and 2d transverse cubital veins are not parallel, but convergent, the 2d submarginal cell therefore trapezoidal.

Habitat.—Cocoanut Grove, Florida.

Described from a single specimen, reared from the larva of an *Arctiid* found on *Chrysobalanus*, and collected by Mr. E. A. Schwarz.

Meteorus orchesiæ n. sp.

Male and female.—Length, $3\frac{2}{5}$ to $4\frac{1}{5}^{mm}$; ovipositor, 3 to 4^{mm}. Head, thorax, 1st abdominal segment, and usually the tips of the abdomen, black; collar, legs, and abdomen, except as mentioned, vary from a honey-yellow to pale yellow ferruginous. The face in the male is ferruginous, antennæ 34-jointed, long; in female antennæ 24-jointed, shorter. The parapsidal grooves are distinct, converge behind, but do not quite reach to the base of the scutellum; the middle lobe posteriorly is finely shagreened; in the male the pleura and scutellum are ferruginous; metathorax coarsely rugose, delicately areolated; the 1st abdominal segment is longitudinally aciculated. Wings hyaline, iridescent; the costæ and stigma brown, the latter having a yellow spot at the base; veins yellowish; the 2d branch of the radius is about twice as long as the 1st, the 2d submarginal cell trapezoidal.

Habitat.—Grand Ledge, Michigan.

Described from six specimens, three males and three females, labeled No. 2465°, reared July 24, 1881, from *Orchesia castanea* found in brown woody fungus growing at the above place.

Meteorus euchromiæ n. sp.

Male and female.—Length, $3\frac{2}{5}$ to $4\frac{1}{5}^{mm}$; ovipositor, 1^{mm}. Pale yellow-ferruginous; eyes very large, purplish brown; palpi and legs pale; post-petiole dorsally black. The antennæ are 25 jointed in female, 31-jointed in the male; parapsidal grooves obliterated, or at least not sharply defined, the middle lobe being more or less shagreened and the parapsidal grooves only indicated by shagreened lines; metathorax minutely rugose, the lateral and medial carinæ only faintly traceable; abdomen normal, the 1st segment or petiole, strongly, longitudinally aciculated. Wings hyaline, iridescent; the costæ to the parastigma, median and submedian, and basal veins dark brown or black; other veins, including the stigma, yellowish; the 2d branch of the radius is only a little longer than the 1st, and shorter than the 2d branch of the cubitus; the 1st transverse cubital nervure is oblique and not interstitial with the recurrent nervure; the 2d submarginal cell is therefore trapezoidal.

Habitat.—Caracas, Venezuela.

Described from several specimens, in both sexes, received September 23, 1886, from Dr. A. Ernst, of Caracas, who reared them from *Euchromia eriphria* Fabr.

Subfamily CALYPTINÆ.

EUBADIZON Nees.

Eubadizon phymatodis n. sp.

Female.—Length, 5mm; ovipositor, $4\frac{4}{5}$mm. Black, polished; face covered with white sericeous pile; palpi pale; legs, excepting posterior coxæ basally, reddish-yellow. Antennæ 28-jointed, black, except the suture between the 2d and 3d joints, tips involuted; when extended backwards the antennæ reach a little beyond the base of the abdomen. The mesothoracic parapsidal grooves are deep and converge and meet before attaining the base of the scutellum, thence as a delicate keel; the sides of the collar and the mesopleura, although shining, are finely rugose; scutellum smooth with a large fovea at base, metathorax and the 1st, 2d, and 3d abdominal segments rugose. Wings hyaline, veins brown, stigma black; the venation as in *E. pleuralis* Cress., only the transverse median nervure is interstitial with the basal nervure.

The male does not differ structurally from the female except in having 31-jointed antennæ and the posterior portion of the middle mesothoracic lobe being coarsely punctulate.

Habitat.—Washington, D. C.

Described from three specimens, two males and one female, reared April 11, 13, and 16, 1889, from *Phymatodes amœnus* Say.

The sculpture of the three basal abdominal segments will at once separate this species from *E. americanus* Cress., to which it seems most closely allied.

Eubadizon incognitus n. sp.

Female.—Length, 3mm; ovipositor, $1\frac{1}{2}$mm. Black, shining, covered with a short, sparse pubescence; face prominent, opaque, finely punctulate, pubescent; two deep foveæ at basal corners of clypeus; palpi pale; antennæ 30-jointed, the two basal joints above black, beneath brown; flagellum brown; mesothoracic parapsidal grooves deep, punctulate at bottom, and converging and meeting before reaching the base of the scutellum; collar at sides confluently punctured; mesopleura smoother, with a deep, punctulate sulcus across the disk; metathorax as long as wide, rugose; legs reddish yellow, the tips of posterior femora and their tarsi slightly dusky; abdomen as long as the thorax, the 1st segment minutely sculptured, with a more or less longitudinal, glabrous line basally; the following segments smooth, polished, the 2d segment only exhibiting a slight microscopical sculpture toward the base. Wings hyaline, the venation as in *E. pleuralis* Cress., only the cubitus is broken near the base and does not attain the apical margin.

Habitat.—Kirkwood, Missouri.

Described from two specimens, received from Miss M. E. Murtfeldt labeled "Parasite on 97M, October 9."

Subfamily BLACINÆ.

GANYCHORUS Haliday.

Ganychorus atricornis n. sp.

Male and female.—Length, $2\frac{3}{5}$ to 3mm; ovipositor, 1mm. Black, polished; palpi and legs, honey-yellow; posterior tibiæ above and tarsi, dusky; mandibles black; antennæ 23 jointed in male, 24 jointed in female; the basal joints of the flagellum are about four times as long as wide; mesothoracic parapsidal grooves deep, punctulate at bottom; mesopleura smooth; metathorax minutely rugose; abdomen oval, depressed, the 1st segment sculptured and with two keels basally, the following segments smooth, polished. Wings hyaline, iridescent; the stigma, parastigma, and most of the costæ black; other veins yellowish; the transverse median nervure is almost interstitial with the basal nervure; the recurrent nervure joins the 1st submarginal cell between the middle and its apex, while the 2d branch of the radius is slightly curved at base.

Habitat.—San Mateo County, California.

Described from three males and one female, labeled No. 147°, reared in December, 1885, by Mr. Albert Koebele, from a Cynipid gall found on *Quercus Douglasii.*

Ganychorus orchesiæ n. sp.

Female.—Length, $2\frac{4}{5}$mm; ovipositor, $2\frac{1}{2}$mm. Stature and color similar to *G. atricornis,* only the antennæ are 23-jointed, brown; the mandibles and palpi yellow; the venter piceo-black; the parapsidal grooves distinct but not deep; the metathorax broader than long, minutely rugose and rounded off posteriorly; the 1st abdominal segment longitudinally aciculated; the legs of a uniform reddish-yellow; the costæ and stigma are brown, while the veins are pale yellow.

Habitat.—Grand Ledge, Michigan.

Described from a single specimen, labeled No. 2465°, reared July 24, 1881, from *Orchesia castanea,* found in brown fungus along with *Meteorus orchesiæ.*

(?) **Ganychorus gelechiæ** n. sp.

Female.—Length, $2\frac{2}{5}$mm; ovipositor, 1mm. A small, elongated, minutely shagreened, opaque, yellow-ferruginous species; the stemmaticum black; the vertex of head, lobes of mesothorax, scutellum, postscutellum, and apical margins of metathorax dusky. The antennæ are more than 20-jointed (broken off at tips), about the length of the insect; the mesothoracic parapsidal grooves are distinct, and converge and meet before attaining the base of the scutellum, the middle lobe thus formed being triangular; the metathorax is a little longer than wide; abdomen long, ovate, as long as the head and thorax together, delicately shagreened. Wings hyaline, narrowed; the transverse median nervure is distinctly interstitial with the basal nervure; other-

wise the venation is similar to the previously-described species; the veins are yellowish.

Habitat.—Kirkwood, Missouri.

Described from a single specimen received from Miss Murtfeldt, labeled "Parasite on *Gelechia prunifoliella*, May 15."

This insect is hardly congeneric with the above species, approaching more closely to the genus *Eubadizon.*

The subfamilies *Calyptinæ* and *Blacinæ* seem to run into each other, and are with difficulty distinguished from each other, the closed anal cell in the former having but slight value.

Subfamily ALYSIINÆ.

DIASPASTA Förster.

In this genus should be placed *Alysia rudibunda* Say.

APHÆRETA Förster.

Aphæreta muscæ n. sp.

Male and female.—Length, 2^{mm}; ovipositor, $\frac{3}{5}^{mm}$. Black, polished; two basal joints of antennæ, mandibles, legs, and 1st abdominal segment honey-yellow; the head is large, transverse, cheeks piceous; antennæ long, 21-jointed, the basal joint swollen, oval; the joints of the flagellum are long, cylindrical, the 2d about one-third longer than the 1st, the terminal joint fusiform and stouter than the one preceding it; in the male the antennæ are longer, 26-jointed; thorax ovoid, smooth, without grooves; metathorax rugulose posteriorly, and with an acute, short, longitudinal carina basally; abdomen oval, the 1st segment slightly aciculated. Wings large, broad, the veins pale brown; the stigma is long and narrow, extending to the apex of the wings; the 2d submarginal cell is very long and narrowed at apex, longer than the length of the basal nervure, the 1st transverse cubital nervure being a little longer than the 1st branch of the marginal nervure and about twice as long as the 2d transverse cubital nervure; the 3d branch of the marginal nervure extends straight across to the apex of the wing, and makes a very large marginal cell.

Habitat.—Fortress Monroe, Virginia, and central Missouri.

Described from many specimens, in both sexes, labeled No. 4309°, reared July 7, 1888, from the puparium of a *Musca* collected at Fortress Monroe; and a single male in Riley collection, labeled Central Missouri.

This species or those described below may be the *A.* (*Trichesia*) *auripes* Prov., Faun. Ent. Can., II, p. 537, but I can not positively tell, Abbé Provancher's description being so imperfect; he does not give the number of joints in the antennæ, nor describe the venation of the wings; if his figure of the wing (Fig. 71) is accurately drawn then none of them can be identical.

Aphæreta californica n. sp.

Female.—Length, $1\frac{1}{5}$ to $1\frac{3}{5}$mm; ovipositor, $\frac{3}{5}$mm. In the number of joints in the antennæ and in color this species is an exact counterpart of the preceding, but it is proportionately smaller; there is a distinct longitudinal grooved line on vertex, extending from ocelli to occiput, and the 2d transverse cubital nervure of anterior wing is much shorter, the 2d submarginal cell being thereby much more narrowed at apex than in *A. muscæ.*

Habitat.—Los Angeles County, California.

Described from six specimens, labeled No. 136°, reared in September, 1886, by Mr. Albert Koebele, from a dipterous larva in dead and injured roots of *Typha latifolia.*

Aphæreta oscinidis n. sp.

Female.—Length, 2mm; ovipositor, $\frac{4}{5}$mm. This species could easily be confounded with both of the above, agreeing with them in colorational details, except as follows: The veins of the wings are dark brown; the apical margins of 3d and 4th abdominal segments are piceous; it has a groove extending from ocelli to occiput as in *A. californica;* but what will readily separate the species are the antennæ; these are 23-jointed.

Habitat.—Washington, D. C.

Described from a single specimen, labeled 4310°, reared July 7, 1888, from a dipterous miner, *Oscinis* sp., mining the leaves of *Plantago major.*

ADELURA Förster.

Adelura subcompressa n. sp.

Male and female.—Length, $1\frac{1}{5}$ to $1\frac{3}{5}$mm; ovipositor, about $\frac{2}{5}$mm. Black, smooth, polished; antennæ, brown; legs, flavo-testaceous; abdomen, piceous; the 1st segment at base and sutures of ventral segments paler. The antennæ in the male are 16-jointed, in the female 15 jointed; the 1st joint of the flagellum is a little longer than the 2d; the 2d and following joints long-moniliform; thorax ovoid, smooth, polished, without grooves; metathorax delicately areolated; abdomen as long as the head and thorax together, subcompressed; the 1st segment delicately aciculated. Wings, hyaline, iridescent; veins, brown; the 2d discoidal cell is much contracted; the recurrent nervure joins the 2d submarginal cell at its basal angle, and is almost interstitial with the 1st transverse cubital nervure; the 2d submarginal cell is very long and narrow, more than twice the length of the 1st; while the 1st branch of the radius is not half the length of the oblique 1st transverse cubital.

Habitat.—Los Angeles County, California.

Described from one male and one female, received from Mr. Albert Koebele, labeled "Observed ovipositing in dipterous larvæ in rotten fungus."

Adelura dimidiata n. sp.

Male.—Length, $1\frac{1}{5}$mm. Black, smooth, polished; flagellum of antennæ, brown; the basal joints of antennæ, palpi, legs, tip of metathorax, more

or less, and the two basal segments of abdomen, pale yellowish; the tip of the abdomen is black or piceo-black. The antennæ are broken off at tips, but the joints of the flagellum remaining are cylindrical, the 1st the longest, the 2d and following about twice as long as wide.

Thorax ovoid, smooth, polished, without grooves; the mesapleura with a crenulate furrow across the disk; metathorax delicately areolated. Wings, hyaline, iridescent, veins, brown; the venation is similar to the preceding species, only the 1st branch of the radius is very short, about one-fifth the length of the oblique 1st transverse cubital nervure; the 2d submarginal cell is, therefore, proportionately widened at base, narrowed at apex.

Habitat.—Ames, Iowa.

Described from one specimen received from Prof. H. Osborn, labeled "Bred from a dipterous larva in stem of cabbage." No date is given.

PHÆNOCARPA Förster.

Phænocarpa americana n. sp.

Female.—Length, $4\frac{2}{5}^{mm}$; ovipositor, $1\frac{2}{5}^{mm}$. Black, polished; antennæ, except dusky toward tips, mandibles, except teeth, and legs, flavo-testaceous. The face and cheeks are covered with a whitish pubescence; the antennæ are broken, but there are 17 joints remaining; the 2d flagellar joint is longer than the 1st, the following gradually becoming shorter and shorter; the mesothoracic grooves are distinct, crenulate; the middle lobe, thus formed, has a distinct, short, longitudinal grooved line posteriorly, connected at apex with two oblique grooves that extend into the parapsidal grooves; the scutellum has a deep fovea at base which is separated into two parts by a delicate keel; metathorax rugose, with a very short medial keel back of the post-scutellum; the abdomen is as long as the head and thorax together, depressed above, boat-shaped beneath; the 1st segment is aciculated, with deep lateral grooves and two delicate, longitudinal keels on the disk, beneath piceous; the following segments are smooth, polished, the sutures being with difficulty made out. Wings, hyaline; stigma and veins, brown; the submedian cell is slightly longer than the median; the 2d discoidal cell long and narrow, a complete parallelogram; the recurrent nervure is interstitial with the 1st transverse cubital nervure, the latter oblique; the 2d transverse cubital nervure is about one-third shorter than the 1st transverse cubital nervure, and surrounded by a brownish spot; the 2d submarginal cell is therefore narrowed at apex.

Habitat.—Washington, D. C.

Described from one specimen.

ISCHNOCARPA Förster.

Ischnocarpa atricornis n. sp.

Male and female.—Length, $2\frac{2}{5}$ to $2\frac{3}{5}^{mm}$; ovipositor, $\frac{2}{5}^{mm}$. Black, polished; the 2d and apical abdominal segments, piceous; palpi and legs

flavo-testaceous; mandibles black at base and with black teeth. The head is transverse; face pubescent and having a longitudinal grooved line on the disk, extending from between the antennæ; there is also a longitudinal grooved line, extending from the front ocellus between the lateral ocelli back to the occiput.

The male antennæ are 21-jointed, female 18-jointed, black, the scape piceous, the 2d joint yellow; the 1st joint of the flagellum is the longest, the 2d and following joints about twice as long as wide. Thorax ovoid, smooth, polished, without parapsidal grooves; posteriorly, just in front of the scutellum, is a short longitudinal medial groove; the scutellum has a deep transverse fovea at base with some raised lines at bottom; on the disk of the mesopleura is a long fovea, punctured at bottom; metathorax finely rugose; the abdomen is as long as the head and thorax together, subsessile, the 1st segment longitudinally striated.

Wings hyaline, iridescent; veins brown; the stigma is long, very narrow, reaching to the apex of the wing; the recurrent nervure joins the 2d submarginal cell near its base; the 1st submarginal cell is small, hardly half the length of the 2d; the subdiscoidal nervure springs from the middle of the 2d discoidal cell.

Habitat—Nyack, New York.

Described from five specimens received February 10, 1885, from Rev. J. L. Zabriskie.

Subfamily DACNUSINÆ.

Œnone Haliday.

Œnone Belfragei n. sp.

Male and female.—Length, 3 to $3\frac{2}{5}$ mm. Black, opaque, rugosely punctate, covered with a sparse, white, sericeous pubescence; two basal joints of antennæ and legs flavo-testaceous. The head is transverse, very short, about twice as wide as long vertically; the eyes are oval and extend to the base of the mandibles; the clypeus projects much below the lower line of the eye, and with the short head and the distended mandibles gives the insect a very peculiar appearance. Antennæ 31-jointed in the male, 29-jointed in the female; the thorax is shorter than the abdomen, with distinct parapsidal grooves, the middle lobe has a punctured longitudinal groove down the center; metathorax areolated; abdomen oval, the sculpture having a longitudinal direction, the 1st segment being more distinctly striated; in the female it is 4-segmented, in the male 5-segmented, the terminal segments being very small. Wings hyaline, iridescent; veins brown; the recurrent nervure joins the 1st submarginal cell between the middle and the apex; the submedian cell is slightly longer than the median.

Habitat.—Texas.

Described from four specimens, two male and two female, in collection Belfrage.

DACNUSA Haliday.

Dacnusa oscinidis n. sp.

Male and female.—Length, $1\frac{3}{5}$mm. Black, smooth, polished; two basal antennal joints, palpi, and legs, honey-yellow; the 1st and two-thirds of the 2d abdominal segments reddish-yellow: antennæ in male 24-jointed (broken in female), cylindrical, very pubescent; the 1st joint of the flagellum is longer than the 2d, the following joints about four times as long as wide; thorax ovoid, smooth, polished, without grooves; metathorax minutely sculptured, pubescent; abdomen oval, the 1st segment finely aciculated and keeled. Wings hyaline, iridescent; veins pale brown; the stigma very large, lanceolate, the marginal nervure springing from before its middle, the 1st branch of which is shorter than the 1st transverse cubital nervure, the 2d branch curving and extending to the apex of the wing, forming a very large marginal cell; the 1st submarginal and the 1st discoidal cells are rather small and about the same size; the submedian cell is longer than the median.

Habitat.—Kirkwood, Missouri.

Described from two specimens, one male and one female, received from Miss M. E. Murtfeldt, labeled "Parasite on dipterous miner, *Oscinis* sp. on honey-suckle, April 6, 1885."

Dacnusa confusa n. sp.

Male.—Length, $2\frac{1}{5}$mm. Black, polished; two basal joints of antennæ and legs, honey-yellow; tarsi dusky. Antennæ 30-jointed, cylindrical, the 1st joint of the flagellum is the longest, slightly longer than the 2d, the following joints after the 3d are about twice as long as wide; thorax ovoid, without parapsidal grooves, but there is a deep longitudinal medial groove posteriorly; in one specimen this groove extends nearly the whole length of the mesonotum, in the other hardly half the length; the scutellum has a large, deep, transverse fovea across the base, separated into two parts by a delicate carina and with some raised lines at the bottom; mesopleura pubescent with a glabrous spot on the disk; mesothorax minutely rugose with a short keel back of the post-scutellum; abdomen oval, depressed, the 1st segment is rugose, the tubercles somewhat prominent, the following segments smooth, polished. Wings hyaline, iridescent; the stigma and veins brown; the stigma is long, lanceolate; the 1st branch of the radius is slightly shorter than the transverse cubital nervure, the 1st submarginal cell is a little larger than the 1st discoidal.

Habitat.—Monroe, Michigan.

Described from two specimens, labeled No. 2464^{oa}; reared from a lepidopterous leaf-miner on rose.

I doubt the correctness of this statement, and rather surmise that this was a *dipterous* and not a lepidopterous leaf-miner, as all other *Dacnusæ* known to me have been reared from dipterous larvæ; unity of habit would therefore exclude the genuineness of this observation.

Dacnusa flavocincta n. sp.

Male.—Length, 2^{mm}. Polished black; legs reddish-yellow; tarsi and posterior tibiæ, dusky; the 2d abdominal segment above, except the extreme apical margin, brownish-yellow, the following segments piceo-black. The antennæ are entirely black, nearly twice the length of the insect, 36-jointed; the 1st joint of the flagellum is two-thirds longer than the 2d, the following joints about twice as long as wide; thorax ovoid, perfectly smooth and without grooves; mesopleura smooth; metathorax minutely rugose, pubescent; abdomen ovate, the 1st segment aciculated and with a longitudinal keel down the center. Wings hyaline; stigma and veins brown; the venation is exactly as in *D. confusa*, only the stigma is slightly narrower, and the 1st branch of the radius is as long as the transverse cubital nervure.

Habitat.—Andersonville, Tennessee.

Described from a single specimen, labeled No. 3084^{01}, reared from a dipterous leaf-miner on wheat. Sent to the Department by Mr. J. K. P. Wallace.

SYNALDIS Förster.

Synaldis ulmicola n. sp.

Female.—Length, $1\frac{2}{5}^{mm}$. Black, polished; legs, including the coxæ, flavo-testaceous; the 1st abdominal segment and venter, piceous. The head is transverse, broader than the thorax, face hairy; antennæ 15-jointed, moniliform beyond the 1st joint of the flagellum, the 1st flagellar joint cylindrical and much thinner than the following joints; thorax ovoid, smooth, polished, without grooves and with some sparse long hairs on the disk; mesopleura with a large crenulate fovea across the disk; metathorax minutely rugose; abdomen ovate, subsessile, depressed above, subcompressed below, the 1st segment aciculated; ovipositor very slightly exserted, black. Wings hyaline, iridescent; veins pale brown; the 1st submarginal cell is very large, nearly three times as long as the 1st discoidal, the 1st branch of the radius being nearly twice as long as the basal nervure; other characters as in *Dacnusa*.

Habitat.—St. Louis, Missouri.

Described from a single specimen, labeled No. $1007P^{o}$, reared October 14, 1878, from a dipterous larva found on elm. Collection C. V. Riley.

This Försterian genus is not included in Mr. Marshall's Monograph of British Braconidæ, but it appears to me to be a valid one, readily separated from *Dacnusa* by the shape of the 2nd submarginal cell and the antennal characters.

CŒLINIUS Nees.

Cœlinius longulus n. sp.

Male.—Length, 5^{mm}. Black, smooth, polished; palpi dusky; the antennæ, except the scape and 2d joint beneath, black; legs testaceous, the coxæ and the 1st joint of the trochanters, piceous black; all tarsi,

and posterior femora above toward apex, and the upper surface of tibiæ, more or less dusky; middle of abdomen reddish, shading into piceous black posteriorly, the 2d segment having a large yellow blotch on the disk.

The oblong head is a little longer than wide, with a distinct grooved line extending from ocelli back to occiput; the antennæ are long and slender, more than 30-jointed (the tips are broken and exact number can not be stated), the 1st joint of the flagellum is the longest, about four times as long as wide, the three following about thrice, and the others twice as long as wide. The mesothoracic parapsidal grooves are only indicated anteriorly, but just in front of the scutellum is a row of coarse punctures, evidently the posterior portion of the grooves; the scutellum has a deep transverse fovea at base, the bottom of which shows some delicate raised lines; the margins of the mesopleura are punctured, the sutures punctulate, the disk smooth but with a longitudinal grooved line a little below the middle; metathorax rugose with indications of a medial carina basally; abdomen long, linear, much longer than the head and thorax together, depressed or compressed from above and below; the petiole is black, as long as the trochanters and femora combined, minutely rugose, the spiracles placed much before the middle. Wings cinereous hyaline; veins dark brown.

Habitat.—Garland, Colorado.

Described from a single specimen collected by Mr. E. A. Schwarz.

This species is the largest form yet discovered in our fauna, and can not be confounded with any other.

Subfamily MACROCENTRINÆ.

ZELE Haliday.

Zele terminalis n. sp.

Male.—Length, $4\frac{1}{5}^{mm}$. Head, thorax, and terminal segments of abdomen, black; metathorax brown; palpi and legs, pale yellow-ferruginous; antennæ black, covered with white hairs; two basal antennal joints and basal two-thirds of 1st joint of flagellum, yellow; the 1st joint of the flagellum is about eight times as long as thick, the others subequal (tips are broken off, but there are 34 joints remaining). The head and thorax are smooth, polished; collar yellow above and at sides, beneath black; parapsidal grooves distinct; mesopleura with a large, oval fovea just beneath the wing, and a broad, longitudinal sulcus below the middle posteriorly, its surface being minutely wrinkled; metathorax coarsely rugose, a little longer than wide; abdomen linear, longer than the head and thorax; the first three segments yellow-ferruginous, and delicately longitudinally aciculated, the following segments smooth, black, and polished. Wings hyaline, iridescent; veins brown; the recurrent nervure interstitial with the 1st transverse cubital nervure.

Habitat.—Missouri. Collection C. V. Riley.

Described from a single male specimen.

This species seems to be entirely distinct from all of the other described forms in our fauna.

Subfamily DIOSPILINÆ.

PROMACHUS Marshall.

Promachus sanguineiventris n. sp.

Female.—Length, 7^{mm}; ovipositor, $5\frac{1}{5}^{mm}$. Head, antennæ, thorax, legs, and ovipositor, black; abdomen sanguineous, attached to the superior margin of the thorax; the tibiæ covered with fuscous pile. The head is smooth, polished; face punctulate, pubescent; antennæ 34-jointed, the length of the insect; thorax smooth; parapsidal grooves deep, broad, smooth, converging and meeting at about half the length of the mesonotum; the middle lobe small and prominent, ending in a carina posteriorly; mesopleura with coarse, deep foveæ on the disk and along the lower and posterior sutures; metathorax coarsely rugose, yellowish-red towards apex; abdomen oval the length of the thorax, the 1st segment with four black keels—two laterals and two on the disk. Wings black; the stigma, costæ, median, submedian, and basal veins, black; other veins brown; tegulæ yellowish.

Habitat.—Missouri. Collection C. V. Riley.

Described from one specimen.

This species might be confused with *Promachus saperdæ* Riley, but its larger size and different sculpture ought to readily distinguish it.

Promachus rubriceps n. sp.

Male.—Length, $3\frac{1}{5}^{mm}$. Head red; stemmaticum and anteriorly to base of antennæ, the occiput, and hinder margins of cheeks to base of mandibles, with the tips of mandibles, black; two basal joints of antennæ, palpi, and legs, honey-yellow; flagellum of antennæ, coxæ, thorax, and abdomen, black. The head in front of the ocelli has deep grooves for the reception of the antennal scape, separated by a sharp ridge extending between the base of the antennæ; the face is minutely punctulate, covered with white sericeous hairs; antennæ 27-jointed, the scape long; sides of thorax rugose covered with long, white hairs; the parapsidal grooves broad, reticulate with coarse punctures, the middle lobe with a distinct carina posteriorly; the scutellum has a deep fovea at base, in the bottom of which are some raised lines; metathorax rugose; abdomen long, ovate, subpetiolate, attached to the upper posterior margin of the thorax, much above the base of the posterior coxæ, and strongly suggestive of an affinity with the *Evaniidæ*. Wings hyaline; the venation as in previous species.

Habitat.—Washington, D. C.

Described from two specimens, labeled No. 2566^{o}, reared February 14, 1884, from *Sternidius alpha*, living in the pith of *Rhus glabra*.

Subfamily OPIINÆ.

OPIUS Wesmael.

Opius anthomyiæ n. sp.

Female.—Length, 4^{mm}. Black, smooth, polished, the terminal segments with the sutures after the 3d more or less piceous; palpi white; legs honey-yellow. The antennæ are long, cylindrical, 40-jointed; parapsidal grooves not impressed; on the posterior portion of the mesonotum, immediately in front of the scutellum, is a large, deep, oval fovea, the bottom of which is transversely wrinkled; mesopleura rugulose beneath the anterior wings and along the basal margins, the disk smoother with an irregular impression; the scutellum is much elevated, the disk rugose, with a deep transverse fovea at base, divided into two parts by a delicate carina; metathorax rugose. The abdomen is cylindric-ovate, sessile, the ovipositor hardly exserted; the 1st segment is sculptured and with lateral longitudinal grooves. Wings hyaline, iridescent; stigma and veins pale brown; the submedian cell is slightly longer than the median; the recurrent nervure joins the 2d submarginal cell at the basal angle, and is almost interstitial with the 1st transverse cubital nervure; the 1st branch of the radius is very short, about one fifth the length of the 2d branch; the 2d submarginal cell is longer than the 1st, and its upper margin is much shorter than the lower.

Habitat.—Lansing, Michigan.

Described from one specimen received from Prof. A. J. Cook, labeled "Ac. Cat. 722, parasite on *Anthomyia*, mining leaves of dock."

Opius foveolatus n. sp.

Male.—Length, 3^{mm}. Black, smooth, polished; the terminal one-third of 2d abdominal segment and the following segments, except sutures, brown; palpi pale; legs reddish yellow. The antennæ are but 35-jointed, slender, cylindrical, pubescent; the parapsidal grooves are sharply defined anteriorly for two-thirds the length of the mesonotum; posteriorly they are entirely wanting; there is an oval depression or fovea on mesonotum just in front of the scutellum, as in previous species, but not so deep; mesopleura smooth, with a shallow, impressed line on the disk; scutellum rugose, foveate at base, the fovea divided into two parts by a carina; metathorax rugose, a carina on the post-scutellum; abdomen ovate, smooth, polished, the 1st segment longitudinally aciculated. Wings hyaline, iridescent; stigma and veins pale yellowish brown; the venation is similar to *O. anthomyiæ*, only the 1st branch of the radius is about half the length of the 2d branch.

Habitat.—Ames, Iowa.

Described from one specimen, received from Prof. H. Osborne, labeled "Parasite on pig-weed leaf-miner." The paucity of joints in the antennæ, less elevated scutellum, sculpture, and venation of anterior wings, will readily separate this species.

PHÆDROTOMA Förster.

(?) Phædrotoma sanguinea n. sp.

Male and female.—Length, $5\frac{1}{5}$ to 6^{mm}; ovipositor, 3^{mm}. Sanguineous, smooth, polished; eyes, stemmaticum, antennæ, legs, and ovipositor black; posterior coxæ red. The antennæ in the male are very long, 48-jointed, in the female broken; the parapsidal grooves are only indicated anteriorly, the middle lobe posteriorly has a deeply-impressed fovea; the fovea at base of the scutellum has several raised lines at the bottom; metathorax somewhat rugose; abdomen sessile, ovate, the upper surface convex, beneath in the male concave, in the female compressed into a keel; the plate of the 1st segment is trapezoidal, its disk lined; the following segments smooth, polished. Wings smoky; the submedian cell longer than the median, and the recurrent nervure joins the 2d submarginal cell just beyond the 1st transverse cubital nervure, almost interstitial with it.

Habitat.—Washington, D. C.

Described from several specimens, labeled No. 3737^x, reared October 3, 1885, from a *Trypeta* living in bolls of *Solanum carolinense.*

Subfamily **LIOPHRONINÆ**.

CENTISTES Haliday.

Centistes virginiensis n. sp.

Female.—Length, $1\frac{2}{5}^{mm}$; ovipositor, $\frac{3}{5}^{mm}$. Black, smooth, polished; antennæ 17-jointed, moniliform, brownish-black; legs brown, obfuscated; parapsidal grooves sharply defined, converging and meeting at base of scutellum; metathorax minutely rugose; abdomen oval, convex above and composed of only three segments. Wings hyaline, pubescent; veins pale brown.

Habitat.—Virginia.

Described from a single specimen, captured at large, May 15, 1881.

Subfamily **HELCONINÆ**.

HELCON Nees.

Helcon grandis n. sp.

Female.—Length, 11^{mm}; ovipositor, 12^{mm}. Black, polished; the pleura, metathorax, and legs piceous; tarsi fulvous. On the vertex are scattered punctures, becoming thicker and confluent around orbits and on face and cheeks; antennæ 38-jointed; parapsidal grooves distinct, coarsely punctured; collar, mesopleura, and metathorax coarsely rugose; scutellum with a large deep fovea at base, separated by a carina into two parts, and each part has a large puncture at bottom; abdomen a little longer than the head and thorax together, subcompressed, smooth, polished, black, except the disks of the two short terminal segments and the sutures of the ventral segments, which are brown. Wings fuscous; stigma and veins piceous black.

Habitat.—Louisiana.

One specimen received from Mr. Tyler Townsend. This species could only be confounded with *H. occidentalis* Cr., but it is larger, and the punctured head, sculpture of pleura and metathorax, and the darker colored legs, will at once distinguish it.

GYMNOSCELIS Förster.

Gymnoscelis yukonensis n. sp.

Female.—Length, 8^{mm}; ovipositor, $6\frac{3}{5}^{mm}$. Polished black, legs rufous, tips of posterior femora, tibiæ, and tarsi, black; sides of abdomen more or less rufous. The vertex of head is smooth with a few widely separated punctures; face roughly punctured, pubescent; the maxillary palpi, long, 5-jointed; prothorax rugosely punctate; mesonotum polished; parapsidal grooves distinct, the disks of the lobes slightly punctured, the posterior surface of the middle lobe rugoso-punctate; mesopleura smooth, polished, the surrounding margins rugose; metathorax and metapleura very coarsely rugose; abdomen long, above, subconvex, the 1st segment and the 2d basally rugose, the following segments smooth. Wings hyaline, veins piceous; the 1st branch of the radius about as long as the 2d, the 2d submarginal cell being trapezoidal.

Habitat.—Fort Yukon, Alaska.

Described from one specimen, received from Mr. L. M. Turner, 1877.

Subfamily APHIDIINÆ.

As the forms in this group have been arranged in accordance with the views of Dr. Arnold Förster, I give below a table for determining the genera:

TABLE OF GENERA.

1. Wings with less than three cubital cells .... 2.
   Wings with three cubital cells.
      Abdomen round; oviduct curved beneath the abdomen.. *G.* (1) *Toxares* Westw.
      Abdomen lanceolate; oviduct not curved beneath the abdomen.
      G. (2) *Ephedrus* Hal.
2. Abdomen lanceolate .... 3.
   Abdomen round; oviduct curved between the abdomen..... *G.* (3) *Monoctonus* Hal.
3. First cubital and first discoidal cells confluent or not existing .... 4.
   First cubital and first discoidal cells separated .... *G.* (4) *Praon* Hal.
4. First cubital cell and first discoidal cell not closed by a transverse vein .... 5.
   First cubital cell and first discoidal cell confluent, closed by a cubital transverse vein.
      Metathorax much hump-shaped .... *G.* (5) *Cœlonotus* Först.
      Metathorax not very hump-shaped.
         Radius much elongated, inclosing more than two-thirds of the radial area.. *G.* (6) *Aclitus* Först.
         Radius shortened, inclosing hardly one-third of the radial area.
         G. (7) *Aphidius* Nees.

5. Radius distinctly present .... 6.
   Radius wholly wanting .... *G.* (8) *Paralipsis*, Först.
6. Wings with no cubital transverse vein .... 7.
   Wings with a cubital transverse vein .... *G.* (9) *Lysiphlebus* Först.
7. Wings with no hind middle humeral cell .... 8.
   Wings with a hind middle humeral cell .... *G.* (10) *Diæretus* Först.
8. Fore middle humeral cell closed; metathorax not areolated .... 9.
   Fore middle humeral cell open; metathorax areolated.
      Female with horn-like appendages on the tip of the abdomen; postmarginal branch shorter than the marginal branch in both sexes. *G.* (11) *Trioxys* Hal.
      Female with no hornlike appendages on the tip of the abdomen; male with a postmarginal which is longer than the marginal branch; radius much elongated .... *G.* (12) *Lipolexis* Först.
9. Female with no horn on the tip of the abdomen .... *G.* (13) *Adialytus* Först.

PRAON Haliday.

(*Aphidaria* Prov., Add. Faun. Hym., p. 152, November, 1886.)

Praon humulaphidis n. sp.

Length, about 3^{mm}. Smooth, polished, bright yellow-ferruginous; vertex of head brown; ocelli, eyes, antennæ, except the two basal joints and base of 3d joint, mesonotum, and scutellum, black; metascutellum convex, brown.

The parapsidal grooves are distinct, sharply defined, converging and almost meeting just in front of the scutellum; metathorax smooth, rounded; the scutellum smooth, with a deep transverse fovea at base; wings, hyaline; veins, pale brown.

Habitat.—Richfield Springs, New York.

Described from one broken specimen, labeled No. 4123^{0}, reared June 15, 1887, from a hop Aphis, *Siphonophora* sp.

I should have refrained from describing this species but for its being a reared specimen with such striking colors that its identification, even from the poor description, can easily be made.

Praon virginiensis n. sp.

Male.—Length, $2\frac{3}{5}^{mm}$. Smooth, polished; the head, antennæ, except two basil joints, and mesonotum, black; clypeus, lower portion of cheeks, mandibles, collar, pleura, metathorax, abdomen, and legs, yellow-ferruginous. The parapsidal grooves are distinct as in previous species, the scutellum is similar; but the metathorax is smooth, with a delicate medial carina; abdomen long lanceolate, longer than the head and thorax together, the disk obfuscated; the petiole is a little longer than wide, with delicate lateral grooves and faint medial keel. Wings, hyaline; veins, brown.

Habitat.—Arlington, Virginia.

Described from a single specimen that had the antennæ broken off at tips.

Sept. 27, 1888

APHIDIUS Nees.

TABLE OF SPECIES.

Males.

1. Antennæ less than 20-jointed .... 3.
   Antennæ 20-jointed .... 2.
   Antennæ more than 20-jointed.
   Black, except the legs.
   Antennæ 26-jointed .... *A. procephali* n. sp.
   Antennæ 22-jointed, sometimes 21-jointed, the two terminal joints being connate .... *A. pterocommæ* n. sp.
2. Second branch of radius not longer than the transverse cubital. *A. avenaphis* Fitch.
   Second branch of radius distinctly longer than transverse cubital... *A. lachni* n. sp.
3. Antennæ 16-jointed .... 4.
   Antennæ 19-jointed.
   Head black or piceous; thorax, abdomen, and legs honey-yellow. *A. xanthus* n. sp.
   Head and thorax black; abdomen brown or piceous.
   Hind coxæ and legs brown; trochanters and knees yellowish. *A. obscuripes* n. sp.
4. Head and thorax black; abdomen black or piceous.
   Middle and posterior coxæ black .... *A. phorodontis* n. sp.

Females.

1. Large size.
   Head and abdomen piceous black; thorax and legs ferruginous. *A. bicolor* n. sp.
   Moderate or small-size species.
   Antennæ 17-jointed or less .... 2.
   Antennæ 19-jointed.
   Hind coxæ black; petiole yellow basally .... *A. californicus* n. sp.
   Hind coxæ pale brown; petiole black .... *A. lachni* n. sp.
2. Antennæ 16-jointed or less .... 3.
   Antennæ 17-jointed.
   Head black or piceous; thorax, abdomen, and legs yellow ferruginous. *A. pallidus* n. sp.
   Head and thorax wholly black .... *A. avenaphis* Fitch.
   Collar, pleura, and metathorax, brown .... var. *A. avenaphis* Fitch.
3. Antennæ 16-jointed.
   Petiole black or piceous, not constricted .... *A. obscuripes* n. sp.
   Petiole wholly yellow, strongly constricted at middle...... *A. confusus* n. sp.
   Antennæ 14-jointed.
   Petiole constricted, basally yellow .... *A. phorodontis* n. sp.

Aphidius bicolor n. sp.

Female.—Length, $5\frac{3}{5}$mm. Head and abdomen piceous black; a blotch back of the ocelli and face ferruginous; antennæ broken at tips; two basal joints ferruginous, flagellum black, the joints being about one and a half times longer than thick; thorax ferruginous, smooth, polished, except the disk of mesonotum, which is shagreened; metathorax black, minutely rugose, its posterior face very oblique and centrally

hollowed, the posterior lateral angles subacute; abdomen long, lanceolate, almost twice as long as the head and thorax together, subcompressed at apex, the tip of the ovipositor being seen projecting upward between the ventral valves; the petiole is about as long as the hind coxæ and trochanters combined, rugose, black, and opaque; legs concolorous with the body, except the posterior tibiæ along their upper surface and their tarsi, which are fuscous. Wings hyaline; veins brown.

Habitat.—Washington, D. C.

Described from one specimen, labeled "D. C., May 18, 1882." It is the largest species known to me, and resembles a species I have reared in Florida from *Lachnus australis*, named in MS. *Aphidius pinaphidis*.

Aphidius procephali n. sp.

Male.—Length, $2\frac{2}{5}^{mm}$. Black, polished; the 3d abdominal suture and legs, except coxæ, brown, anterior pair of legs paler, coxæ black, the middle and anterior pairs brownish at apex; antennæ, 26-jointed, entirely brown-black, the joints of flagellum being a little longer than wide; disk of mesonotum aciculated; metathorax areolated; abdomen long ovate, depressed; the petiole rugose, about thrice as long as wide; wings, hyaline, iridescent; veins, brown; the 2d branch of the radius about as long as the transverse cubital nervure.

Habitat.—Washington, D. C.

Described from one specimen, labeled No. 1021P°, reared April 7, 1883, from an Aphis, *Procephalus* sp. found on *Pinus inops*.

Aphidius pterocommæ n. sp.

Male.—Length, $2\frac{4}{5}^{mm}$. Black, polished; abdomen, piceous black; legs, dark brown; coxæ and trochanters, black; posterior femora, piceous black; antennæ, 22-jointed (in one specimen the two terminal joints are connate, making but 21 joints); the joints of the flagellum are hardly twice as long as wide; thorax entirely smooth, polished; metathorax areolated, the surface of some of the areolæ more or less punctured; abdomen long ovate, depressed; the petiole rugose, twice as long as wide, and constricted at the middle; wings, hyaline; veins, brown; the 2d branch of the radius much longer than the transverse cubital nervure.

Habitat.—Washington, D. C.

Described from two specimens, labeled No. 2939°, reared April 5, 1883, from willow Aphid, *Pterocomma salicicola* Uhler.

Aphidius avenaphis Fitch.

Praon avenaphis Fitch, Sixth N. Y. Report, p. 98.

Specimens of what are undoubtedly this species are in the collection, labeled 2721[01], reared June 17 and 20, 1882, from the wheat Aphis, *Siphonophora avenæ.* Some specimens agree exactly with Fitch's description; others vary considerably in color, having the collar, pleura, metathorax, and abdomen entirely brown or more or less dusky; the female has but

17-jointed antennæ, a fact not mentioned by Fitch; the specimens with 20-jointed antennæ, as described by him, being males.

Habitat.—Washington, D. C., and Lafayette, Indiana. (F. M. Webster.)

Aphidius lachni n. sp.

Female.—Length, $2\frac{2}{5}^{mm}$. Black, polished; collar to tegulæ, and more or less of mesopleura, and the legs, including all coxæ, pale ferruginous; abdomen, piceous; the sutures, pale; petiole, black. The antennæ are 19-jointed, black; the suture between 2d and 3d joints only pale; the joints of the flagellum are at least twice as long as thick, pubescent; thorax smooth, impunctured; metathorax areolated; the legs, metathorax, petiole, and abdomen are more distinctly covered with white hairs than usual; the petiole is nearly thrice as long as wide, black, delicately sculptured, and slightly constricted at the middle; wings, hyaline; the veins, dark brown; the 2d branch of the radius being about one and a half times as long as the transverse cubitals.

The male differs from the female in having a darker colored abdomen, either black or piceous; the 2d suture only pale, while the antennæ are 20 or 21 jointed, the long terminal joint being sometimes divided into two joints.

Habitat.—Alameda County, California.

Described from several specimens, labeled No. 367°, reared in November, 1887, by Mr. Albert Koebele, from an Aphid, *Lachnus* sp., on Poplar.

Aphidius californicus n. sp.

Female.—Length, $2\frac{2}{5}^{mm}$. Black, polished; the mouth parts pale; legs honey-yellow, hind coxæ black; anterior half of the strongly constricted petiole, honey-yellow; postpetiole, black; the sutures between petiole and 2d and between the 3d and 4th segments, pale yellowish. The antennæ are 19 jointed, much more slender than in *A. lachni*, the joints of the flagellum being at least two and a half times as long as wide; thorax smooth, impunctured; metathorax, areolated and rugose; abdomen about one-third longer than the head and thorax together, long, lanceolate, pointed at apex. Wings, hyaline; veins, brown; the basal nervure almost black; the 2d branch of the radius is nearly twice the length of the transverse cubital nervure.

Habitat:—Placer County, California.

Described from one specimen, labeled "Placer County, Cal., August," and sent to the Department by Mr. Albert Koebele.

Aphidius obscuripes n. sp.

Female.—Length, 2^{mm}. Black, polished; face, mouth parts and antennal tubercles, brownish-yellow; legs brown; front coxæ and femora, except along the upper surface, and all trochanters, pale brownish-yellow; hind coxæ and femora unicolorous, dark brown; abdomen piceous brown, the 2d, 5th, and 6th sutures yellowish-white. The antennæ are

16-joint, black, the joints of the flagellum are about two and a half times longer than thick, the terminal joint being longer and stouter; thorax smooth, polished, the upper margin of collar, triangular piece in front of the tegulæ, and the tegulæ piceous or brownish; metathorax smooth, distinctly areolated; abdomen as usual, long, lanceolate, about twice as long as the thorax; the petiole about twice as long as wide, with prominent tubercles. Wings hyaline; stigma and veins pale, the basal nervure brown; the 2d branch of the radius is not as long as the transverse cubital nervure, the latter being hyaline.

The male has 19-jointed antennæ, the metathorax piceous, the 1st and 2d abdominal sutures only pale, while the veins of anterior wings are a little darker, and the 2d branch of the radius is, at least, as long as the transverse cubital.

Habitat.—Lafayette, Indiana.

Described from two specimens, one male and one female, labeled No. 83^7, received from Mr. F. M. Webster.

Aphidius xanthus n. sp.

Male.—Length, $1\frac{3}{5}^{mm}$. Honey-yellow, smooth, polished; head black, disk of mesonotum obfuscated or brownish; antennæ 19-jointed (?); thorax with parapsidal grooves anteriorly which become obsolete before attaining the middle of mesonotum; metathorax smooth, polished, not areolated; abdomen longer than the head and thorax together; the petiole about thrice as long as wide and of a uniform thickness throughout, the spiracles not prominent; wings hyaline; veins pale brown, subhyaline; the 2d branch of the radius is about as long as the transverse cubital nervure.

Habitat.—Bushberg, Mo.

Described from a single specimen in Riley collection, labeled No. $700P^{01}$, reared September 23, 1876, from a seed-pod-shaped gall on *Solidago.*

From this gall were also reared Cecidomyious flies, and it is indicated in Professor Riley's "Note Book" as a Cecidomyid gall, but the rearing of this parasite would, however, seem to indicate that the gall was Aphidian and that the *Aphidius* and the *Cecidomyia* were true parasites.

I have reared *Cecidomyiæ* from Aphids in Florida, Mr. James Fletcher from Aphids in Canada, and several instances of such rearings are recorded abroad.

Aphidius pallidus n. sp.

Female.—Length, 2^{mm}. Smooth, polished; head black, face piceous; thorax, legs, and abdomen, pale yellow-ferruginous, the dorsum of mesonotum piceous black, the dorsum of abdomen pale brownish. The antennæ are 17-jointed, black, the two basal joints pale beneath; the joints of the flagellum are hardly thrice as long as thick; metathorax areolated; abdomen normal; the petiole is yellowish-white, about twice as long as wide, slightly narrowed basally, the spiracles distinct, but

not prominent. Wings hyaline; veins pale; the 2d branch of the radius is more than twice as long as the transverse cubital nervure.

Habitat.—Lafayette, Ind.

Described from one specimen received from Mr. F. M. Webster.

Aphidius phorodontis n. sp.

Female.—Length, $1\frac{2}{5}$mm. Black, polished; mouth parts pale; legs and abdomen rufo-piceous; trochanters, knees, and the petiole of abdomen at base, yellowish. The antennæ are 14-jointed, very slightly and gradually thickened toward apex, black, the two basal joints piceous, the 3d and 4th joints beneath yellowish, the joints beyond the 5th are about twice as long as thick; the parapsidal grooves are faintly distinguishable anteriorly; metathorax areolated, the surface of the areolets somewhat wrinkled; the abdomen is not longer than the head and thorax combined; the petiole about thrice as long as wide, the post-petiole widened. Wings hyaline; stigma and veins pale; the 3d discoidal cell is very narrow; the 2d branch of the radius as long as the transverse cubital nervure.

The male differs from the female in having 16-jointed antennæ.

Habitat.—Ottawa, Canada.

Described from several specimens, labeled No. 4273°, received from Mr. James Fletcher, January 9, 1889, and bred from *Phorodon mahaleb.*

Aphidius confusus n. sp.

Female.—Length, 2mm. Black, polished; legs honey-yellow, the upper surface of anterior and middle femora and tibiæ, brown; the posterior coxæ, femora, and middle of tibiæ, black; abdomen honey-yellow, disks of the segments pale brownish. The antennæ are 16-jointed, black; the joints of the flagellum are about twice as long as thick; the mesothoracic parapsidal grooves are slightly indicated anteriorly; metathorax smooth, areolated; abdomen a little longer than the head and thorax together, lanceolate; the petiole a little more than thrice longer than wide and slightly narrowed at base. Wings hyaline; stigma and veins pale brown; the 2d branch of the radius only slightly longer than the transverse cubital nervure.

Habitat.—Los Angeles, California.

Described from a single specimen, received from Mr. Albert Koebele. This specimen was reared in April from an Aphis on orange.

LYSIPHLEBUS Förster.

TABLE OF SPECIES.

Males.

1. Antennæ 15-jointed or less .... 2.
   Antennæ 18-jointed.
      Collar, pleura, and metathorax black; petiole short, brown.
         L. cerasaphis Fitch.
      Collar, pleura, and metathorax yellow; petiole long, yellow.
         L. multiarticulatus Ashm.

2. Antennæ 14-jointed .... 4.
Antennæ 15-jointed.
Head and thorax not entirely black .... 3.
Head and thorax entirely black.
Hind coxæ black or black basally.
Petiole black or piceous .... *L. cucurbitaphidis* n. sp.
Petiole yellow or yellowish-brown.
Terminal antennal joint not longer than the preceding.
L. eragrostaphidis n. sp.
Terminal antennal joint longer than the preceding.
L. Coquilletti n. sp.
Hind coxæ not black, either testaceous or yellow.
Hind tarsi as long as their tibiæ; third antennal joint nearly thrice as long as thick .... *L. citraphis* Ashm.
Hind tarsi shorter than their tibiæ; third antennal joint hardly twice as long as thick .... *L. myzi* n. sp.
3. Face yellow; collar, pleura, and metathorax rufo-testaceous... *L. ribaphidis* n. sp.
Face piceous; collar yellow, pleura black, metathorax piceous at apex.
L. testaceipes Cress.
Variable; wholly brownish piceous or yellow-ferruginous .... *L. minutus* n. sp.
4. Hind and middle coxæ black, or at least so basally; legs brown.
L. abutilaphidis n. sp.
Hind coxæ brown.
Face piceous; terminal antennal joint not or hardly longer than the preceding joint .... *L. baccharaphidis* n. sp.
Face black; terminal antennal joint one-third longer than the preceding joint .... *L. gossypii* n. sp.
Hind coxæ yellow.
Petiole yellow, the abdomen shading into black posteriorly .... *L. tritici* n. sp.

Females.

1. Antennæ 13-jointed or less .... 2.
Antennæ 14-jointed.
Middle and posterior coxæ piceous black; legs dark brown .. *L. piceiventris* n. sp.
2. Antennæ 12-jointed .... 3.
Antennæ 13-jointed.
Middle and posterior coxæ black or brown-black.
Metathorax black; terminal antennal joint one-third longer than the preceding joint.
Petiole short; brown or black .... *L. cucurbitaphidis* n. sp.
Petiole long yellow .... *L. abutilaphidis* n. sp.
Metathorax piceous or brown; petiole brown; terminal antennal joint not longer than the preceding .... *L. gossypii* n. sp.
Hind coxæ black or black basally.
Hind tarsi not longer than the hind tibiæ.
Legs pale brownish-yellow, sometimes obfuscated.
L. eragrostaphidis n. sp.
Legs bright honey-yellow .... *L. Coquilletti* n. sp.
Hind tarsi distinctly longer than hind tibiæ.
Hind femora and tibiæ dark brown; petiole yellowish, the 1st abdominal segment brown .... *L. baccharaphidis* n. sp.
Hind femora and tibiæ honey-yellow; petiole and the 1st abdominal segment yellow .... *L. persicaphidis* n. sp.

Antennæ 13-jointec—Continued.
All coxæ brownish yellow, sometimes dusky basally.
Basal joint of hind tarsi not longer than the three following joints.
Antennæ brown to brown-black, but yellowish beneath, the two basal joints, and one, two, or more of the following joints always yellowish beneath .... *L. citraphis* Ashm.
Basal joint of hind tarsi as long as the four following joints.
Antennæ brown-black .... *L. myzi* n. sp.
All coxæ honey-yellow.
Legs honey-yellow; posterior femora and tibiæ sometimes brown.
Terminal antennal joint fusiform twice the length of the preceding joint; hind legs usually brown .... *L. testaceipes* Cress.
Terminal antennal joint not twice the length of the preceding.
Joints of flagellum twice as long as thick .... *L. tritici* n. sp.
Joints of flagellum about thrice as long as thick.
L. salicaphis Fitch.
3. Color variable; wholly brownish-piceous or yellow-ferruginous .. *L. minutus* n. sp.

Lysiphlebus multiarticulatus n. sp.

Male.—Length, 2^{mm}. Upper portion of head, mesonotum, and scutellum black, the rest of the insect yellow-ferruginous; antennæ 18-jointed, acuminated toward apex, brown-black, the two basal joints beneath brownish-yellow, the joints of flagellum about two and a half times as long as thick; metathorax delicately areolated; all tibiæ and tarsi fuscous; abdomen ovate, the petiole and 2d segment yellowish, beyond brown; wings hyaline; veins pale brown, the stigma subhyaline.

Habitat.—Lafayette, Indiana.

Described from one specimen, received from Mr. F. M. Webster.

Lysiphlebus ribaphidis n. sp.

Male.—Length, $1\frac{4}{5}^{mm}$. Head and thorax black; face, base of antennæ, and legs honey-yellow; collar, pleura, and apex of metathorax rufo-testaceous; abdomen flavo-testaceous, dorsally dusky or brown. Antennæ 15-jointed, flagellum brown, the joints hardly thrice as long as thick. Wings hyaline; veins brown-black, the stigma whitish.

Habitat.—Lafayette, Indiana.

Described from two specimens labeled No. 3935°, received from Mr. F. M. Webster. These specimens were reared July 12, 1886, from the currant Aphis.

Lysiphlebus piceiventris n. sp.

(?) *Female.*—Length, $1\frac{3}{5}^{mm}$. Black, smooth, polished; antennæ, legs, and abdomen dark brown or piceous, middle and posterior coxæ black, posterior femora obfuscated; antennæ 14-jointed, the joints of the flagellum about twice as long as thick; metathorax smooth on the disk, with delicate ridges at sides; abdomen ovate, the petiole short, gradually widened posteriorly, with prominent spiracles a little before the middle, the 1st and 2d abdominal sutures pale; wings hyaline, veins brown.

Habitat.—Los Angeles, California.

Described from a single specimen, received from Mr. Albert Koebele.

Lysiphlebus cucurbitaphidis n. sp.

Female.—Length, 1^{mm}. Black, smooth, polished; antennæ dark brown, 13-jointed, the 1st joint of the flagellum is slightly more than twice longer than thick, the following joints about twice as long as thick, the terminal joint being longer; legs brown; the anterior and middle coxæ and all the trochanters yellowish, the posterior coxæ and sometimes the middle pair basally, black or brown-black; abdomen dark brown, the petiole very short, widened behind; wings hyaline, veins brown; the radius is very angularly bent, the 2d branch being as long as the 1st. The male has 15 jointed antennæ, flagellar joints twice as long as thick, the last not longer than the preceding.

Habitat.—Lafayette, Indiana.

Described from many specimens, labeled No. 3610^{01}, reared by Mr. F. M. Webster from *Siphonophora cucurbitæ* Thomas.

Lysiphlebus eragrostaphidis n. sp.

Male and female.—Length, 2^{mm}. Black, smooth, polished; legs pale brownish-yellow, the posterior coxæ black except at tip, the posterior femora, tibiæ, and tarsi dark brown, the tibiæ at base yellowish; the basal joint of tarsi is not longer than the three following joints; metathorax smooth, delicately areolated; abdomen long, lanceolate, pointed at apex, the petiole smooth, yellow, slightly widened posteriorly, the following segments, except sometimes the base of the second, are dark brown, shading into black towards apex, the 3d segment occasionally has a pale spot laterally. Wings hyaline; the stigma and veins dark brown. The female has 13-jointed antennæ, the 1st joint of the flagellum is hardly thrice as long as thick, the following joints slightly shorter, the terminal joint being fusiform and twice as long as the preceding. The male has 15-jointed antennæ, the joints of the flagellum being about twice as long as thick, fluted, the terminal joint pointed and longer than the preceding; the legs are usually darker than in the female; the anterior and middle pairs usually obfuscated along the upper surface, the posterior pair being much darker, the middle and posterior coxæ are sometimes black basally, the apex brown; the abdomen is long ovate, the petiole yellow, the following segments dark reddish-brown.

Habitat.—Lafayette, Indiana, and Los Angeles, California.

Described from specimens received from Mr. F. M. Webster, labeled "Swept from *Eragrostis*, October 4, 1885;" and specimens received from Mr. Coquillett, labeled No. 92, reared from an Aphis on *Eragrostis;* and others labeled, "Parasite on *Siphonophora* sp. on *Audibertia stochoides.*"

Lysiphlebus Coquilletti n. sp.

Male and female.—Length, 2^{mm}. Black, smooth, polished; legs honey-yellow, a dark streak along the upper surface of middle femora and tibiæ, the posterior coxæ black at base, their femora black or brown-black, their tibiæ, except at base and the tarsi, brown; abdomen long

lanceolate, pointed at tip, the petiole honey-yellow, 3d and 4th sutures pale. Wings hyaline, stigma and veins brown. The female has 13-jointed antennæ, the two basal joints yellowish-brown beneath, the joints of flagellum nearly thrice as long as thick, the terminal joint very large fusiform, twice as long as the preceding joint. The male has 15-jointed antennæ, dark brown, the joints of the flagellum are only about twice as long as thick, the terminal joint not longer than the preceding, fusiform; the legs are darker than in the female, the middle tibiæ and tarsi dusky; abdomen ovate, black, the petiole yellowish; the 2d branch of the radius is not as long as the 1st.

Habitat.—Los Angeles, California.

Described from five specimens, received from Mr. Coquillett, labeled No. 99, reared from *Myzus* species on *Hosackia glabra*. This species is very close to *L. eragrostaphidis* and may be a variety.

Lysiphlebus citraphis Ashm.

? *Aphidius citraphis* Ashm., Orange Ins., 1880, p. 71.
Trioxys testaceipes Cress. (pars), U. S. Agri. Rep., 1879, p. 208.
Aphidaria basilaris Prov., Add. à la Faune Hym., p. 396, 1888.

This species is parasitic on the orange Aphis, *Siphonophora citrifolii* Ashm.; it is identical with some of the forms described by Mr. Cresson (*loc. cit.*), but as that author confused three species, which bear a superficial resemblance to each other, reared from the cotton Aphis, orange Aphis, and wheat Aphis, I have retained the name given by me to the species reared from the orange Aphis, his name for the species reared from the cotton Aphis, and given the name *L. tritici* to the species reared from the wheat Aphis, which, under the circumstances, is, I believe, admissible. See the table for the characters that separate them.

Lysephlebus myzi n. sp.

Male and female.—Length, 2^{mm}. Black, smooth, polished; metathorax smooth with delicate lateral ridges; coxæ brownish yellow, the posterior pair dusky basally, the trochanters and legs yellowish, the middle femora, and the posterior femora and tibiæ and tarsi, more or less brown; the basal joint of hind tarsi is about as long as the four following joints; abdomen long, lanceolate, pointed at apex, and at least one-third longer than the head and thorax together, brown, the petiole yellow, apex of 2d and base of 3d and 4th segments pale. Wings, hyaline; stigma and veins pale brown; the 2d branch of the radius is shorter than the 1st. The female has 13-jointed antennæ, dark-brown, the suture between the 2d and 3d joints pale, the 1st joint of the flagellum is almost thrice as long as thick, the following joints more than twice longer than thick, the terminal joint being one-third longer than the preceding. The male has 15-jointed antennæ, the 3d joint being hardly twice as long as thick; the posterior tarsi are shorter than their tibiæ; the abdomen, including the petiole, brown, the apex of 2d segment yellowish-white.

Habitat.—Lansing, Michigan.

Described from four specimens, labeled No. 258[x], reared from currant Aphis, *Myzus ribis* Linn., received from Prof. A. J. Cook.

Lysiphlebus testaceipes Cress.

Trioxys testaceipes Cress., U. S. Agric. Report, 1879, p. 208.

Habitat.—Southern States.

Many specimens of this species are in the collection, all reared from the cotton Aphis. No. 46[a] reared May 19, 1879; others at Selma, Alabama, by Mr. W. H. Patton, October 19, 1879, and at Wedgefield, South Carolina, by Mr. Thomas McCutcheon, July 24, 1886.

Lysiphlebus gossypii n. sp.

Male and female.—Length, 1 to $1\frac{1}{5}$mm. Black, smooth, polished; metathorax piceous, delicately areolated; legs brown or piceous, all trochanters and anterior and middle legs beneath and knees of posterior legs, paler; middle coxæ black basally, posterior coxæ black, tips pale; abdomen long, lanceolate, pointed at apex, black beyond 2d segment; petiole yellow at base, piceous posteriorly, 1st suture whitish, 2d segment piceous, the apex and 2d suture pale. Wings hyaline; stigma and veins pale brown; the 2d branch of the radius about as long as the 1st. The antennæ in female are 13 jointed, dark brown, the joints of flagellum a little more than twice longer than thick, the terminal joint not longer than the preceding. The male has 14-jointed antennæ, the joints of flagellum a little more than twice longer than thick, the 1st joint of flagellum being stouter than the others, the terminal joint being slightly longer than the preceding, fusiform; the basal joint of hind tarsi is hardly as long as the three following joints united.

Habitat.—Columbia, South Carolina.

Described from many specimens, labeled No. 2400, received from Prof. G. F. Atkinson, and reared from cotton Aphis, *Aphis gossypii.*

Lysiphlebus abutilaphidis n. sp.

Male and female.—Length, $1\frac{1}{5}$mm. Black, smooth, polished; metathorax smooth, delicately areolated, black; legs honey-yellow, two-thirds of the hind coxæ basally and their femora brown; abdomen long, brown, the sutures a little paler, the extreme apex black, the petiole very long, very narrow at base, and bright yellow or sulphur yellow; wings hyaline, the stigma and veins pale brown, the 2d branch of the radius much shorter than the 1st.

The antennæ in the female are 13-jointed, dark brown, slightly thickened toward apex or subclavate, the 1st joint of flagellum hardly twice as long as thick, the following joint a little longer or about two and a half times as long as thick, the terminal joint being the longest and thickest joint, about one third longer than the preceding. In the male the antennæ are 14-jointed, uniformly cylindrical throughout, the joints of the flagellum being about two and a half times as long as thick, except the 1st joint, which is slightly longer, the terminal joint being much longer than the preceding; the legs are brown, the middle and

posterior coxæ black or black basally; the abdomen ovate, brown, the petiole as wide at base as at apex and yellowish brown.

Habitat—Los Angeles, California.

Described from four specimens received from Mr. D. W. Coquillett, labeled No. 93, reared from an Aphis *Siphonophora* sp. on abutilon.

Lysiphlebus tritici n. sp.

Male and female.—Length, $1\frac{3}{5}^{mm}$. Black, smooth, polished; metathorax smooth, black, with delicate lateral ridges; legs, including coxæ, honey-yellow, the posterior femora sometimes pale brownish; abdomen as usual, brownish-piceous, the petiole honey-yellow, slightly widened posteriorly; wings hyaline, the stigma and veins pale brown, the 2d branch of the radius as long as the 1st.

The antennæ in the female are 13-jointed, brown, the joints of the flagellum about twice as long as thick, the terminal joint about one-third longer than the preceding. The male has 14-jointed antennæ, the joints of the flagellum about two and a half times as long as thick, the terminal joint being longer and thicker than the others; the abdomen is brown, black at apex, the petiole and the basal portion of the 3d segment honey-yellow, or pale yellow-ferruginous; the hind tarsi are about as long as their tibiæ, the basal joint being about as long as the three following joints.

Habitat—Cadet, Missouri.

Described from several specimens received from Mr. J. W. Barlow, labeled No. 2721, reared June 20, 1882, from wheat Aphis, *Aphis avenæ*.

Lysiphlebus persicaphidis n. sp.

Female.—Length, 2^{mm}. Black, smooth, polished; face piceous; metathorax smooth, black, delicately areolated; legs, including coxæ, pale yellow-ferruginous, the posterior tarsi being distinctly longer than their tibiæ, about the length of the last joint; the abdomen long lanceolate, hardly one-third longer than the head and thorax together, pointed at apex; the petiole and 1st segment and base of 3d pale yellow-ferruginous, from thence dark brown; wings hyaline, stigma and veins brown, the 2d branch of the radius is a little shorter than the 1st.

The antennæ are 13-jointed, piceous black, the 1st joint beneath pale yellow-ferruginous, the joints of the flagellum less than thrice as long as thick, the terminal joint longer, fusiform.

Habitat.—Fresno County, California.

Described from one specimen received from Mr. Albert Koebele, reared in May, 1886, from Aphis on peach.

Lysiphlebus baccharaphidis n. sp.

Male and female.—Length, $1\frac{3}{5}^{mm}$. Black, smooth, polished; face more or less piceous, the clypeus prominently convex and always piceous; metathorax areolated; legs pale brownish, the posterior pair dark brown, their coxæ black, trochanters and knees pale yellowish; abdomen long lanceolate, brown, the petiole and 3d segment along the sides

pale or yellowish; wings hyaline; stigma and veins brown; the 2d branch of the radius only half the length of the 1st.

The antennæ in the female are 13-jointed, brown-black, the tip of 2d joint being pale, the joints of flagellum about two and a half times as long as thick, the terminal joint being longer than the preceding.

The male has 14-jointed antennæ, the joint of the flagellum being a little more than twice as long as thick, the terminal joint not longer than the preceding; legs and abdomen brown; the 2d branch of the radius is about as long as the 1st branch.

Habitat.—Los Angeles, California.

Described from four specimens labeled No. 94, received from Mr. D. W. Coquillett, reared from an Aphis on *Baccharis viminalis.*

Lysiphlebus salicaphis Fitch.

Trioxys salicaphis Fitch, First Report, p. 136.

In the collection are specimens of a species, agreeing with Dr. Fitch's description, labeled No. 165°L, reared by Prof. Riley from grape Aphis, *Siphonophora vitifolii* Thos., in Missouri; also other specimens reared at the Department, September 10, 1886.

DIÆRETUS Förster.

Diæretus americanus n. sp.

Male.—Length, $1\frac{3}{5}$mm. Black, smooth, polished; two basal joints of antennæ pale yellow-ferruginous, flagellum dark brown; palpi, white; collar sides piceous; the triangular piece just beneath base of anterior wing very hairy; legs, pale brownish-yellow; metathorax, black; abdomen, brown, blackish toward apex; petiole, yellowish.

The antennæ are longer than the insect, 18-jointed; the joints of the flagellum less than thrice as long as thick, the terminal joint being nearly twice as long as the preceding; mesothorax smooth, polished, the parapsidal grooves distinct, converging and almost meeting at base of scutellum; metathorax areolated by a delicate medial longitudinal keel and lateral keels, microscopically punctate, finely pubescent; abdomen ovate, the petiole very slightly longer than wide, the sides parallel. Wings, hyaline; the stigma and veins brown. There is a cubital vein starting from near the apex of the basal vein, almost from the parastigma, and extending entirely across the wing to the apex; hind wing with a single closed humeral cell.

Habitat.—Lafayette, Indiana.

Described from two specimens received from Mr. F. M. Webster.

Diæretus Websteri n. sp.

Male.—Differs from the preceding in having 19-jointed antennæ, the two basal joints yellowish, the 1st joint of flagellum being thrice as long as thick, the following slightly shorter, the terminal joint not longer than the preceding; the abdomen is brownish-yellow, dusky toward apex, the petiole not longer than wide; while the metathorax is without the delicate longitudinal medial keel.

Habitat—Lafayette, Indiana.

Described from one specimen received from Mr. F. M. Webster.

Diæretus brunneiventris n. sp.

Male.—Differs from both of the above in having the face and lower portion of the cheeks brownish-yellow, and the triangular piece beneath anterior wings, sides of collar and metathorax, brown. The abdomen is brown; the petiole yellow, a little longer than wide, the spiracles prominent. The antennæ are 19-jointed, the two basal joints and the base of the 3d, honey-yellow, the flagellum brown-black, the 1st joint thrice as long as wide, the others slightly shorter, the terminal joint shorter than the preceding.

Habitat.—Lafayette, Indiana.

Described from one specimen received from Mr. F. M. Webster.

This genus, with the genera *Toxares*, *Ephedrus*, *Monoctonus*, and *Praon*, all have a complete cell in the hind wing, the other genera (except, possibly, *Cœlonotus* and *Aclitus*, which are unknown to me) are without a cell.

TRIOXYS Haliday.

Trioxys rhagii n. sp.

Female.—Length, $2\frac{3}{5}$mm. Black, smooth, polished; clypeus piceous; palpi brown; antennæ 11-jointed, the first three joints yellowish, flagellum black, the 1st joint of the flagellum is cylindrical, the same thickness throughout and a little thinner than the following joints, the following joints slightly shorter, the last being the longest joint and at least one-third longer than the preceding; mesonotum smooth, without parapsidal grooves; metathorax distinctly areolated; legs, including coxæ, flavo testaceous; abdomen long, lanceolate, piceous-black, terminating in two long prongs, the oviduct curved downward between them, the ovipositor slightly exserted; the 1st and 2d sutures are yellowish-white, the petiole twice as long as wide, the spiracles situated a little beyond the middle. Wings hyaline; costæ and basal veins brown; stigma and the other veins pale; the radius is long, about twice the length of the post-marginal; hind wings without a cell.

Habitat.—Ridgewood, New Jersey.

Described from one specimen in Riley collection, labeled No. 275x, reared November 16, 1871, from *Rhagium lineatum*.

LIPOLEXIS Förster.

TABLE OF SPECIES.

Males.

Antennæ 17-jointed .... *L. piceus* Cress.=*T. rapæ* Curtis (?).
Antennæ 16-jointed.
  All coxæ dark brown or black .... *L. chenopodiaphidis* n. sp.
  Hind coxæ black only at base, others yellow .... *L. salicaphidis* n. sp.

Females.

Antennæ 15-jointed .... *L. salicaphidis* n. sp.
Antennæ 14-jointed .... *L. piceus* Cress. = *T. rapæ* Curtis (?).
Antennæ 13 jointed .... *L. chenopodiaphidis* n. sp.

Lipolexis piceus Cress.

Trioxys piceus Cress., U. S. Agric. Report, 1879, p. 260.
? *Aphidius* (*Trionyx*) *rapæ* Curtis, Farm Insects, p. 73.

I can discover no difference between this species and specimens of an insect received from Mr. E. A. Fitch, of Essex, England, named *Trioxys rapæ* Curtis, but there is some doubt in my mind as to whether this is Curtis's species, as Mr. Marshall, in his catalogue of British Hymenoptera, places *T. rapæ* of Curtis in the genus *Toxares* Westwood.

The species is parasitic on *Aphis brassicæ* Linn., and has been reared from this Aphid by different observers from Florida to California.

Lipolexis salicaphidis n. sp.

Male and female.—Length, $1\frac{3}{5}$mm. Black, smooth, shining; mouth parts pale; the antennæ are 15-jointed in the female, the 1st joint of the flagellum about thrice as long as thick, the following joints shorter; in the male there are 16 joints, the joints of the flagellum about equal in length, the terminal joint not being longer than the preceding; metathorax areolated; legs honey-yellow, the posterior coxæ at base and their femora, tibiæ, and tarsi obfuscated or brown; abdomen long, lanceolate in the female, the petiole dull yellow, the rest of the abdomen piceous black; wings hyaline, the stigma and veins pale brown. The petiole in the male shows only a little yellow at base.

Habitat.—Los Angeles, California.

Described from six specimens labeled No. 73, received from Mr. D. W. Coquillett, reared from an Aphis on *Salix.*

This species can not be the *Trioxys salicaphis* Fitch on account of the number of antennal joints.

Lipolexis chenopodiaphidis n. sp.

Male and female.—Length, 2 to $2\frac{1}{5}$mm. This species is very similar to *L. piceus* Cress., but the female has but 13 joints in the antennæ, the male 16 joints. All the coxæ in the male are piceous black, the legs being dark brown, the knees paler, the abdomen dark brown, with pale sutures in the male; in the female the abdomen is brown, the anterior and middle coxæ and all trochanters honey-yellow; the terminal joint in the female is much longer than the preceding joint, while in the male it is not as long as the preceding joint.

Habitat.—Los Angeles, California.

Described from five specimens, labeled No. 80, received from Mr. D. W. Coquillett, reared from an Aphid on *Chenopodium album.*

ALPHABETICAL INDEX.

[Pages in heavy type contain important references.]

A.

B.

I.

N.

T.

U.